Epileptic seizure detection Using Wireless Sensor Networks

Mots clés :

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Domaine scientifique principal : Divers

Résumé du projet de recherche (Langue 1)

Medical Wireless Sensor Networks (WSNs) are comprised of numerous small devices attached to or implanted in the body of a patient to collect vital signs. At present, many existing medical wireless devices are used to collect various patient metrics and vital signs, such as Heart Rate (HR), pulse, oxygen saturation (SpO2), Respiration Rate (RR), Body Temperature (BT), ElectroCardioGram (ECG), ElectroMyoGram (EMG), Blood Pressure (BP), Blood Glucose Levels (BGL) and Galvanic Skin Response (GSR). These networked medical sensors accumulate and transmit collected data to a central device (i.e. base station, PDA, smart phone) for processing and storage, This data may be then reevaluated and used to trigger medical alarms for caregivers or healthcare professionals, upon detection of anomalies in the physiological data, or clinical deterioration of monitored patients, to quickly react [1, 2, 3] by taking the appropriate actions. The use of WSNs has been extended to monitor individuals having chronic illnesses (i.e. cardiovascular, Alzheimer's, Parkinson's, Diabetes, Epilepsy, Asthma) where these networks have enhanced the quality of life by: (i) reducing the healthcare costs (overcapacity, waiting, sojourn time, number of nurses, etc.), and (ii) providing mobility, while continuously collecting and relaying critical physiological data to their associated healthcare providers, e.g. long-term monitoring of patient recovery from surgical procedure after leaving the hospital, kinematic and rehabilitation assessment. Medical sensors with wireless capabilities are available in the market (MICAz, TelosB, Imote2, Shimmer [4], etc.). For example, ECG wireless sensor is connected to three electrodes attached to the chest for real time monitoring of heart problems. The pulse oximeter is used to measure the pulse and blood oxygenation ratio (SpO2), through the use of infrared light and photosensor. These valuable information can be exploited to detect asphyxia, insufficient oxygen (hypoxia) or pneumonia. A normal SpO2 ratio typically exceeds 95%. When this ratio is lower than 90%, an emergency alarm must be triggered due to possible lung problems or respiratory failure. Several monitoring systems based on WBANs have been proposed for the early detection of epileptic seizures. These systems raise an alarm when detecting abnormal changes in one or many physiological parameters. The performance analysis of the proposed system show that more than 20% of raised alarms are false alarms and are not associated with an epileptic seizure. We want to develop a new approach to enhance the accuracy of epileptic seizure detection mechanisms. The proposed approach will be based on correlating the statistical values of EEG, ECG, EMG and accelerometer during the seizure. Modeling the patient motions before and after the seizure is necessary to enhance the accuracy and to reduce the false alarms.

Résumé du projet de recherche (Langue 2)

Informations complémentaires (Langue 1)

This research activity will be in collaboration with three research groups from USA (Florida Atlantic University) and China (Beijing Univ. of Post and Telecommunications. Some visits will be planned during the PhD thesis period.

Informations complémentaires (Langue 2)

Required Skills: -* Sensor networks hardware and software architectures (TinyOS, …) -* Anomaly Detection -* Security -* Machine Learning and Data Mining -* Decision Theory -* Statistical data analysis. Programming skills in C/C++, MatLab, TinyOS/NestC. Writing in english, autonomy and initiative.