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Remote Monitoring of Soldier Safety through Body Posture Identification using Wearable Sensor Networks

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Abstract: The physical safety and well being of the soldiers in a battlefield is the highest priority of Incident Commanders. Currently, the ability to track and monitor soldiers rely on visual and verbal communication which can be somewhat limited in scenarios where the soldiers are deployed inside buildings and enclosed areas that are out of visual range of the commanders. Also, the need for being stealth can often prevent a battling soldier to send verbal clues to a commander about his or her physical well being. Sensor technologies can remotely provide various data about the soldiers including physiological monitoring and personal alert safety system functionality. This paper presents a networked sensing solution in which a body area wireless network of multi-modal sensors can monitor the body movement and other physiological parameters for statistical identification of a soldier's body posture, which can then be indicative of the physical conditions and safety alerts of the soldier in question. The specific concept is to leverage on-body proximity sensing and a Hidden Markov Model (HMM) based mechanism that can be applied for stochastic identification of human body postures using a wearable sensor network. The key idea is to collect relative proximity information between wireless sensors that are strategically placed over a subject's body to monitor the relative movements of the body segments, and then to process that using HMM in order to identify the subject's body postures. The key novelty of this approach is a departure from the traditional accelerometry based approaches in which the individual body segment movements, rather than their relative proximity, is used for activity monitoring and posture detection. Through experiments with body mounted sensors we demonstrate that while the accelerometry based approaches can be used for differentiating activity intensive postures such as walking and running, they are not very effective for identification and differentiation