

(which may pose an important problem in other body area networks with multiple sensing nodes) is irrelevant as the proposed network just consists of two nodes. Moreover, the Bluetooth specification natively implements different mechanisms at different layers (authentication, confidentiality, authorization, etc.) to guarantee secure communications, which is a crucial concern for the viability of any m-health (mobile health) sensor network and medical BANs.

In the proposed system, as soon as a fall is detected by the *app* in the smart watch an alerting message is transmitted to the smartphone via Bluetooth. A fall is only assumed to have occurred if the *app* running in the smartphone also detects a fall event within a short interval of 1 s before or after the reception of this message. In that case, a local acoustic alarm is triggered in the smartphone. If this local alarm is not deactivated by the user before 20 s, an automatic emergency call (or a text message) is sent to a preset contact phone number.

Accordingly, aiming at reducing the occurrence of false positives, the procedure for remote alerting is not initiated if the detection is only accomplished in a single device.

VI CONCLUSION

This paper proposes and evaluates a fall detection system that benefits from the detection performed by two popular personal devices: a smart phone and a smart watch (both provided with an embedded accelerometer and a gyroscope). In the proposed architecture, a specific application in each component permanently tracks and analyses the patient's movements. In the future a diverse fall detection algorithms (commonly employed in the literature) will be implemented in the developed Android

apps to discriminate falls from the conventional activities of daily living of the patient. As a novelty, a fall is only assumed to have occurred if it is simultaneously and independently detected by the two Android devices (which can interact via Bluetooth communication). The system was systematically evaluated in an experimental tested with actual test subjects simulating a set of falls and conventional movements associated with activities of daily living.

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