A wearable fall-detection system based on Body Area Networks for smart cities

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Abstract

Falls can have serious consequences for people, which can lead, for example, to restrictions in mobility or in the worst case to traumatic based cases of death. To provide rapid assistance, a portable fall detection system has been developed which is capable of detecting fall situations and, if necessary, alerting the emergency services without any user interaction. The prototype was designed to facilitate a reliable fall-detection and to classify several fall-types. This solution represents a life-saving service for every inhabitant which would significantly enrich the development of smart cities and smart factories where fall-events are part of daily-life. This paper will also introduce the fall analysis, which includes the generation of test events. To guarantee functional safety, the hazard analysis method STAMP (System-Theroetic Accident Model and Processes) will be applied.

Keywords: e-Health, fall-detection, Body Area Network, safety, STAMP, Smart City

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1. Introduction

Fall-detection is gaining in importance not only in aging societies, but also in working society and in daily activities. According to the World Health Organization (WHO), 646,000 fatal falls are estimated to be the second leading cause of accidental or unintentional death worldwide each year. People over 65 suffer the most fatal falls. Another high risk group is children. Taking into consideration their evolving developmental stages, the increasing curiosity to explore the environments or the inadequate adult supervision lead to fall-events [1]. In everyday life we are also confronted with the risk of falling, during the night shift in a factory or practicing dangerous sport disciplines can lead to fatal falls. Annually 37.3 million fall-events are severe enough to require medical treatment [1].

2. Related Work

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3. Background

4. Fall-detection system prototype

4.1. Architecture

4.2. Sensor fusion

ECG

4.3. Generation of test-events

Lorena's part

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References

[1] World Health Organization (WHO), Fact - sheets : Falls, `http://www.who.int/news-room/fact-sheets/detail/falls`, Last access: 08-07-2018.

[2] R. Feynman, F. Vernon Jr., The theory of a general quantum system interacting with a linear dissipative system, Annals of Physics 24 (1963) 118–173. `doi:10.1016/0003-4916(63)90068-X`.

[3] P. Dirac, The lorentz transformation and absolute time, Physica 19 (1-–12) (1953) 888–896. `doi:10.1016/S0031-8914(53)80099-6`.