FEASIBILITY STUDY OF REMOTE IN-DOOR FALL DETECTION

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Abstract

The use of a Stepped-Frequency Continuous Wave (SFCW) radar is proposed for non invasive fall detection. A fall in principle involves changes both in position and in speed. Measurements have been performed with the radar fixed both on the wall and on the ceiling. In both situations, position and speed of a target have been measured with good accuracy. By combining this information a fall can be properly detected distinguishing the fall from both walking and sitting measurements. The results show the feasibility of this approach. Moreover, the vital signs can be monitored also.

Keywords: bioelectronics, biosignals.

1 Introduction

The elderly population (60 years and older) in the world has been steadily increasing. The situation has resulted in a growing need for healthcare approaches for elderly people to stay at home independently as long as possible. Falls and sustained injuries among elderly are a major problem worldwide [1].

Fall detection is currently being achieved through active involvement of the individual, which imposes an important risk factor. The ideal solution is a contactless approach. Current systems under investigation are based on video cameras, acoustic and floor vibration sensors [2]. Due to the high number of “false positives”, these approaches are not able to work under real and practical conditions.

2 SFCW Radar

The SFCW radar transmits a group of *N* coherent CW pulses whose frequencies are increased from pulse to pulse by a fixed frequency increment Δf. Due to its wideband nature, an SFCW radar allows to detect speed and distance with a good accuracy. These two quantities are exploited to detect a fall. For this kind of application, an SFCW radar presents several advantages compared to both CW radar, that is not able to detect distance, and UWB IR radar, due to its hardware complexity.

3 Results

In order to detect speed and position of a person, measurements have been performed by fixing the SFCW radar both on the ceiling and on the wall.

The results clearly show how the SFCW radar can determine the absolute distance of a person both in upright position and lying position. Regarding the speed, the results clearly show the difference between a fall and a normal movement (walking or sitting). During a fall (Fig. 1), the speed continuously increases until the sudden moment when the fall is finished, whereas during walking or sitting down, the Doppler signal experiences a controlled movement.

With this work, for the first time we give a proof of remote fall detection by using radar techniques.

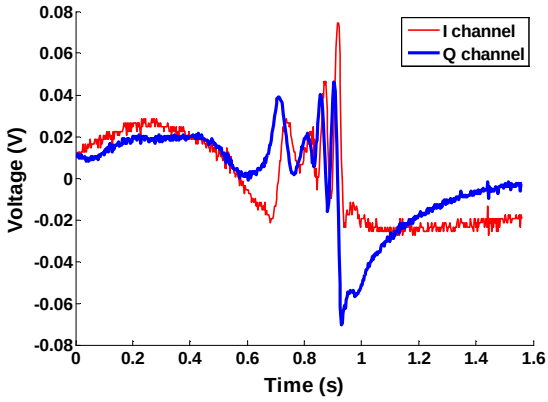

Fig. 1 – Speed signal during a fall. The frequency of the signal is altered proportionally to the velocity of the person during the fall.

References

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