Researcher develops a fall detection device for elderly people

Connected to clothing articles, the device is able to identify falls through body sensors

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The use of combined resources, services and assistive technologies to improve the performance and quality of life of individuals with reduced mobility is on the rise. One of the research topics in this area is the use of fall detection devices by the elderly, who are subject to several risk factors for falls, risks which are deepened by the ever-increasing longevity of the population and the growing number of elderly living by themselves.

With the purpose of finding efficient and sustainable solutions to help solve this ageing adversity, the MSc in Control Engineering from UFRGS, Guilherme Torres, developed, as part of his master's thesis, a wearable device that works as a wireless network of devices that can identify falls through sensors adapted to a smart home system, which can connect several home appliances – from refrigerators and smart TVs to systems of illumination and air conditioning – to the Internet, and program them to interact.

The individual is monitored by an accelerometer and a three-axis gyro. Coupled to the wearer's clothing (near the chest), together they are able to detect falls through an algorithm that analyzes the device's data. "Based on the data from the accelerometer, we merge these signals and generate a series of user's movement data, such as walking, running, jumping and sitting," Torres explains.

Monitoring is conducted through an accelerometer and a three-axis gyro. - Photo: Rochele Zandavelli/UFRGS
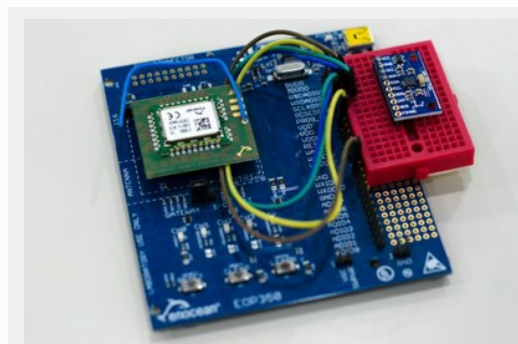
The equipment uses German EnOcean technology, which is based on the exploration of wireless technologies and energy capture. Primarily used in automated systems, it provides connection to a smart home automation system through the Home Assistant system, a digital open source platform for home automation that allows you to control and verify the range of home appliances through electronic devices and applications.

With an automatic detection of falls and interconnection with the smart home system, the device assists in monitoring the elderly and triggering emergency alarms. This detection uses information from the inertial sensors to distinguish ordinary movements from falls. In total, the device has been tested for four types of fall movements and four types of movements that do not characterize as falls.

Regarding the results of the research, in addition to validating the EnOcean technology for use in wearable devices, the prototype developed did not indicate any false positive in the tests performed with two users with different body features. Each one of the eight types of movements were repeated 100 times. "As we know the characteristics of non-fall movements, we compare those with fall movements, so we can discover certain patterns that identify both. In other words, when the user falls, the signal that appears is identified, and thus, when a fall occurs, the device emits an alarm that is received by the smart home system and can be uploaded to the internet," says the researcher.

Torres' fall detection system contributes to the research area of assistive technologies integrated into smart home systems. It was elaborated considering real situations, that is to say, routine movements of falls, and also user-friendliness. Torres is currently considering the possibility of improving the device, working on its miniaturization and new tests in a future post-graduate study program.

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