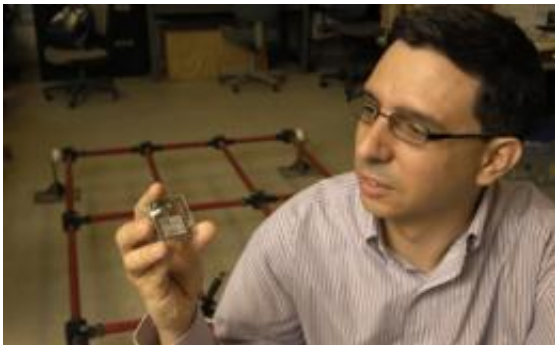# Fall monitoring device could end standoffs, keep seniors safer

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Researchers' efforts lead to less intrusive, more precise sensor

(Medical Xpress) -- It's a scenario played out all too frequently: Adult children, worried about the safety of their aging parents, foist devices on them to monitor their safety. And their parents, resentful of having their privacy invaded and losing their independence, resist fiercely.

Now a team of researchers from the University of South Carolina and Environment and Health Group Inc. is developing and testing a simple, innovative program that might just end such standoffs – and create a safer environment for seniors.

The program is the brainchild of professors in USC's College of Engineering and Computing and faculty at the University of South Carolina School of Medicine, the College of Social Work, Palmetto

Health and Environmental Health Group Inc.

Lead USC researcher Juan Caicedo has taken standard sensors that monitor bridge safety and developed an algorithm that can detect and possibly prevent falls by sensing vibrations associated with an individual's movement. The matchbox-sized sensors, which are placed on a floor or a baseboard of a room, can detect any movement or vibration and then transmit them to a nearby computer.

"The beauty of the program is that it does not use cameras or microphones, so it is a lot less intrusive," Caicedo, a professor of civil engineering, said. "Someone can't listen to what you are saying or see inside your home. Although sensors are not new, the innovation is in how the different signals are processed."

Caicedo is working with colleagues Michael Huhns, June Shin and Paul Ziehl in the College of Engineering and Computing and Dr. Victor Hirth (USC School of Medicine) and Sue Levkoff (College of Social Work and SeniorHOME, Endowed Chair), and Debra Krotish, primary investigator from Environment and Health Group Inc.

Under the direction of Levkoff, SeniorSMART, funded by the Smart State Centers of Economic Excellence program, was established to improve the lives of older adults by creating products and services, and conducting research to promote independence.

"In this case, the program detects the vibrations, (a possible fall), the exact spot of the vibrations and then estimates the force of impact of the object hitting the floor," Caicedo said. "It can identify the impact of a small ball bouncing or the weight of an adult."

After the vibrations are transmitted to the computer, they can be transmitted to a family member's cell phone or computer. So, finding

Mom or Dad early after a fall is helpful, but can it prevent falls? And if so, then how? Caicedo said the sensors are sensitive enough to detect gait patterns. "If someone begins to walk more slowly or shuffle, then the sensors will detect the change in the vibrations and transmit that to the computer. This is particularly helpful because it could detect the subtle, long-term changes that might go unnoticed by friends and family members and identify who is at risk."

To exclude competing vibrations that could, literally, send mixed signals, Caicedo is refining his technique through rigorous testing in his lab and at area retirement homes, including Still Hopes Episcopal Retirement Home, The Lutheran Homes of South Carolina and The Oaks Retirement Homes in Orangeburg, S.C.

He has created a steel grid, about the size of an extra-long double bed and a foot off the floor to simulate a floor and affixed three sensors. Using hammers, Caicedo and his team hit the steel grid with varying degrees of force, from a light tap to a forceful smack. The algorithm is able to correctly estimate the location and force of the impact based on the acceleration measurements only.

Krotish, also executive director of SeniorSMART, said Caceido's research has huge implications for aging adults and their families.

"This is an excellent example of taking an existing technology and using it in an innovative way to help people," she said. "In this case, this technology will preserve quality of life and save in health care dollars."

Falls are "gateway incidents" and the leading cause of admission to nursing homes and assisted care living facilities.

"Falls are a major source of morbidity and mortality for older adults," Krotish said. "More than one-third of adults age 65 and older fall each

year, and that rates increases to 40 or 50 percent for adults 80 and older.

Preventing them will preserve quality of life in older adults and save on fall-related health care costs, which are estimated to reach $32.5 billion in 2020 as the number of [older adults](#) grows.

The research is funded by the Alzheimer's Association and an NIH Small Business Innovation (SBIR) Grant to Environment and Health Group Inc.

Provided by University of South Carolina