Stair Guidance System

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Problem Statement

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Elderly people are at heightened risk for tripping and falling. Given that their bodies are increasingly fragile, a fall may lead to extreme injury or death. The elderly are 8 times as likely as younger people to die from a fall.¹

Market Potential

- 2.5M ER cases a year are geriatric fall patients²
- 2 existing companies: Hip-Hope[™], B-Shoe[™]

Goal of our Project

Develop a device to prevent elderly people from tripping on stairs.



Figure 1: (a) Prototype layout (b) Processor Module (c) Sensor Module

THRESHOLDING AND LOGIC



Figure 2: Prototype feedback algorithm

Studies and Results Methods User wears Stair Guidance System properly User places foot in the middle of a room, at least Scenario 1 5' from any objects, and holds for 30 s

The number of true positives, false positives, true negatives, and false negatives is recorded User places foot flat on floor, less than 3' from a Scenario 2 stair, and holds for 30 seconds The number of true positives, false positives, true negatives, and false negatives is recorded Scenario 3

User raises foot 9" in the air, and holds for 30 s

The number of true positives, false positives, true negatives, and false negatives is recorded User moves foot forward until it is 3" away from

Scenario 4 the next stair, and holds for 30 s The number of true positives, false positives,

true negatives, and false negatives is recorded

Repeat for 4 more users

Proposed Solution (cont.) Studies and Results (cont.)

Results



The Stair Guidance System prototype had 100% accuracy in scenarios 1 and 2, and 70% accuracy in scenarios 3 and 4. One to two false positives or false negatives occurred in scenarios 3 and 4.

Conclusions

- The device is not close enough to 100% accuracy yet. It is not yet ready for clinical trials.
- Next step: Conduct a study in a gait lab with seniors who meet our patient criteria to determine whether this therapy is truly helpful.
- Future improvements: The final design iteration will embed all components inside user's shoe.

References

- 1. Alexander, B H, F P Rivara, and M E Wolf. "The Cost And Frequency Of Hospitalization For Fall-related Injuries In Older Adults." American Journal of Public Health 82.7 (1992): 1020-023. Print.
- 2. "Important Facts about Falls." Centers for Disease Control and Prevention, Centers for Disease Control and Prevention, 21 Sept. 2015. Web. 8 Oct. 2015.



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