ExerBalance

BALANCE BOARD-BASED SYSTEM FOR FALL PREVENTION IN OLDER ADULTS

Problem

The increase in quality of life over the past century led to the growth of life expectancy, turning population increasingly older. Consequently, age related problems are more common. One of these problems is falls and their grave consequences. As age degrades biological elements that control body balance, falls become more frequent and severe. Fall prevention programs usually integrate several complementary methods. One of them is exercise that improves balance in older adults, decreasing risk, and strengthening the body, mitigating them. However, motivating seniors to do healthy exercises is difficult.

The main objective of this project is to study the relationship between older adults and interactive exergames and to provide a solution for their poor motivation towards regular exercise practice. In addition, the Nintendo Wii Balance Board (WBB) features are explored evaluate the player's balance automatically as it can measure the player's center of pressure (COP), enabling the provision of metrics that can help supervisors to monitor patients.
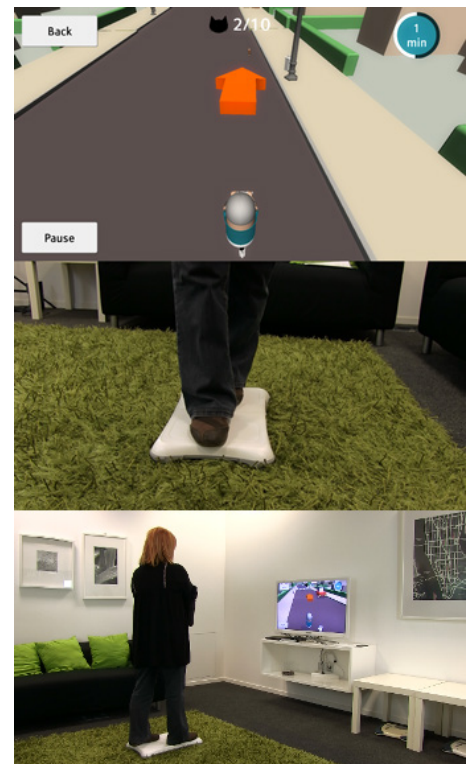

Fig1.   Scooter Chase screenshot, feet position and senior playing.

Solution

Two interactive exergames were developed. These games require performing exercises that are part of the main fall-prevention programmes, such as Otago Exercise Programme or Fitness and Mobility Exercise, and balance assessment scales as well, such as Berg Balance Scale. In Scooter Chase, the player rides a scooter with the goal of catching a cat. To move the character, the player must perform a heel toe stance on top of the WBB and to turn, the user rotates a smartphone (Figure 1). A balance assessment is

Contact

Rua Alfredo Allen, 455
4200-135 Porto, Portugal

+351 220 430 300
info@fraunhofer.pt
www.fraunhofer.pt

Balance Assessment

While the user plays the game, the system is capable of computing several metrics in run-time, enabling a further analysis of the exercise and balance.

Metrics

- COP's mean velocity
- COP's total oscillation
- COP's path
- COP's amplitude
- COP's frequency
- Variance
- Standard deviation
- Maximum time maintaining a stance

Fig2. Senior performing a forward reach movement in order to play Segway Stroll.

given automatically at the end of the game based on the maximum time the player could maintain the pose and accordingly to the Tandem Stance Test. In Segway Stroll, the player travels through the city with a Segway. To accelerate, the player must perform a forward reach movement, as seen in Figure 2, and to break, toe raises. To turn, the player has to exert more pressure on one side of the WBB.

While the user is performing a heel toe standing in Scooter Chase or a standing stance in Segway Stroll, the system computes balance metrics based on the COP. This data is intended to be evaluated by physiotherapists or care-takers to monitor the seniors' balance.

Conclusion

The system was evaluated in two set of tests with a total of 17 seniors with age between 64 and 80 years old where they had the opportunity to interact with the exergames.

Although most of them did not fully understand the games' mechanics and logic at their first attempt, all of them

stated they enjoyed the experience and would like to play regularly as they motivated them to do exercise. COP's path and amplitude over time graphs were drawn and examples can be seen in Figure 3.

This solution can hopefully lead seniors to increase the practice of physical activity and eventually decrease fall risk while providing physiotherapists a mean to monitor the evolution of balance of their patients.
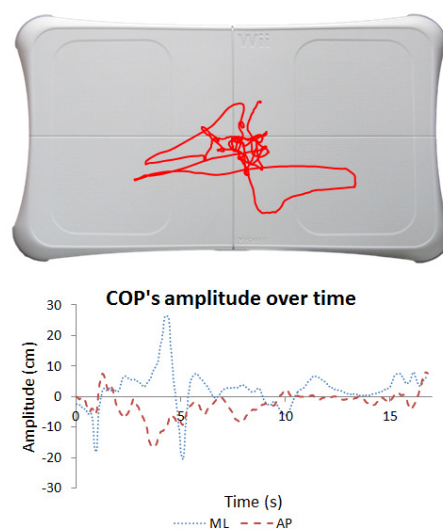

Fig3. COP's path and amplitude over time graphs.