

VR-Rides: Interactive VR Games for Health

Kiran Ijaz^(✉), Yifan Wang, David Milne, and Rafael A. Calvo

School of Electrical and Information Engineering, University of Sydney,
Sydney, NSW 2006, Australia

{Kiran.ijaz,Yifan.Wang,David.Milne,
Rafael.Calvo}@sydney.edu.au

Abstract. VR Rides is a virtual reality game that aims to engage older adults in physical and cognitive exercise to reduce their risk of developing dementia. The experience combines a recumbent tricycle, real-world imagery (sourced from Google Streetview), an Oculus Rift headset and a Microsoft Kinect camera, such that the player can navigate real locations in a safe virtual environment. Using this platform, we further developed two game designs: Competitive (ghost/virtual player as opponent to guess visited cities) and affiliative (virtual tour to invoke and share memories). Our immediate goal involves deploying VR Rides into retirement homes, so that it can be evaluated in a realistic setting. The first primary measures of these experiments will focus on engagement and usability of older adults. However, we would also ideally measure the outcomes of using this platform on players' mobility and spatial skills in future.

Keywords: Virtual reality · Immersive VR games · Exergames · Health games

1 Introduction

Dementia is the most prevalent cause of disability in older adults. Globally, there are currently 46 million people living with dementia, and this figure is projected to rise to 130 million by 2050. The global economic burden is currently estimated at 818 billion USD, and projected to rise to over two trillion by 2030 [1].

Physical activity is widely recognized as key for reducing one's risk of dementia [2]. Unfortunately, age has a profound effect on mobility. This is particularly true for those suffering dementia, who often have great difficulty navigating and recognizing familiar locations [3]. Consequently, a simple walk around the neighborhood can be a frustrating and frightening experience. Many live an understandably sedentary life.

In this paper we present VR Rides, a combination of technologies that allows the user to safely cycle around almost any real-world location, without encountering traffic or worrying about getting lost. We hope that this computer game will engage older adults in physical and cognitive exercise, and consequently reduce their risk of developing dementia as possible outcome.

Older adults are far from the target audience for emerging technologies such as the Rift and the Kinect. However, we hope that in this case the technology will fade into the background to create a truly intuitive experience; one where there are no confusing

buttons or fanciful environments. The user instead simply cycles around a location that they are already familiar with, just as they would in real life.

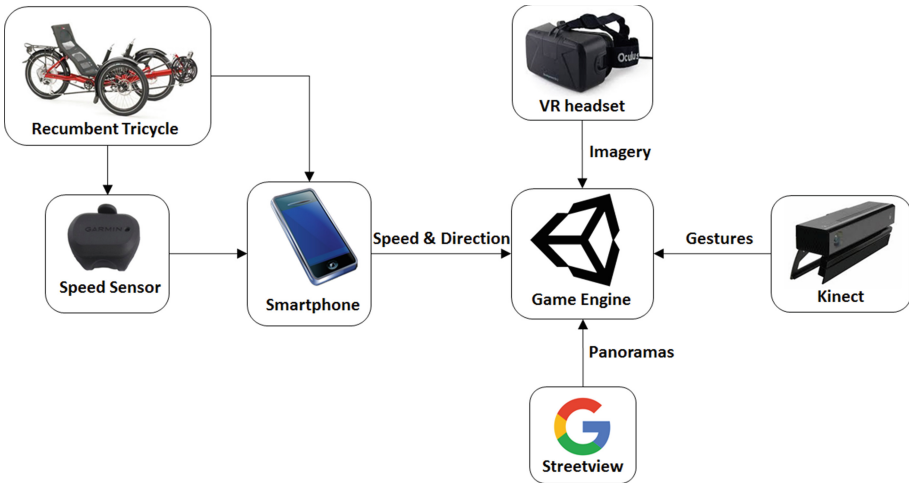


Fig. 1. VR rides architecture

VR Rides use a stationary recumbent tricycle as a game controller and to navigate the virtual environment (Fig. 1). A speed sensor and smart phone connected to the back wheel can track speed and direction of the cycle during the trip. The sensor's information is further passed to the Unity game engine that generates immersive virtual environment based on Google streetview imagery. The same game engine enables players to experience immersive VR environment with the help VR headset. Players can also interact with the game using natural hand gestures through a Kinect camera.

The key challenge of this project is to create a VR experience that older players will find appealing. It is common understanding that older adults are less likely to engage with technology simply for technologies sake, and may not be familiar with or respond well to traditional game mechanics. After establishing the VR platform with aforementioned technology, we developed two distinct game modes:

- *A competitive Guess Game*, in which players need to locate nearby landmarks in an unknown place to guess the city name. The activity is not a flat-out race (which would cause safety concerns for our older players), but is instead a strategic cycle ride that requires players to guess where the landmarks are located, and plan an efficient route between them.
- *An affiliative tour*, in which players take a virtual tour of famous cities by navigating around familiar historical locations. They can intuitively point out landmarks that have personal significance using the Kinect, and can describe the memories they evoke using a microphone. Tours and generated picture gallery are ideally shared with a friend, child or grandchild, but can also be saved and played back later.

McCallum and Boletsis [4] provide a recent review of dementia related games, and explain that while such games have a positive effect on cognitive-impaired patients, more research is required to measure whether the effects are persistent or can transfer to daily activities. The primary measures of these experiments focused on usability and engagement: e.g. whether players voluntarily register for future sessions with the bike. Participants' feedback suggest that VR Rides was well received and had successfully engaged older adults during the sessions.

2 Interaction

After initial familiarization with VR headset and trike, player can participate to play one of the two games. An immersive experience with VR Rides is demonstrated in Fig. 2. Both games start with an in-game tutorial that lets player understand the game components and mechanics. Once the player master the basic interaction, he is presented with first level of the game based on the game mode initially selected.



Fig. 2. An older adult riding the trike in immersive VR environment

Overall interaction is much the same across both modes. Both involve the participant using the Oculus Rift headset to freely look around a photo-realistic location, and then steering/pedaling the bicycle to navigate to between locations. In the competitive mode, players are asked to guess the cities they are navigating. In the affiliate mode, they have to follow a virtual tour of some of the world's famous cities, they can point out significant locations through gestures, take photographs and hear pre-recorded audio.

3 Conclusion and Future Work

VR Rides is an interactive virtual reality platform that motivates older adults to engage in physical and cognitive exercise. The two game designs use real-world imagery which provides flexibility of cycling in any real world location. Competitive guess game aims to challenge players to navigate familiar environments; in contrast, affiliative virtual tour allows players to share memories and locations that are of personal significance. Our primary aim is to encourage and engage elderly for physical and cognitive activity in an entertaining way. VR-Rides provide an intuitive setup where participant has to simply pedal to navigate in the virtual environment. In future, we would preferably measure use of these games for player's mobility and spatial skills.

References

1. Prince, M., Wimo, A., Guerchet, M., Gemma-Claire, A., Wu, Y.-T., Prina, M.: World Alzheimer Report 2015: The Global Impact of Dementia - An analysis of prevalence, incidence, cost and trends, p. 84 (2015)
2. Farrow, M., Ellis, K.: Physical activity for brain health and fighting dementia. Alzheimer's Aust. Paper 36 (2013)
3. Zakzanis, K.K., Quintin, G., Graham, S.J., Mraz, R.: Age and dementia related differences in spatial navigation within an immersive virtual environment. *Med. Sci. Monit.* **15**, CR140–CR150 (2009)
4. McCallum, S., Boletsis, C.: Dementia games: a literature review of dementia-related serious games. In: Ma, M., Oliveira, M.F., Petersen, S., Hauge, J.B. (eds.) *SGDA 2013. LNCS*, vol. 8101, pp. 15–27. Springer, Heidelberg (2013)