ENHANCING EXERCISE MOTIVATION USING VIRTUAL REALITY GAMING SYSTEM

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ABSTRACT:

Virtual reality (VR) applications are currently used for a variety of clinically based domains—most notably in rehabilitation and behavioral medicine. However, its application as a physical activity and health promotion tool among healthy population, is indeed limited. A small number of commercially available VR-based exercise systems have incorporated a game-play element into its apparatus, an attempt to develop a more enjoyable and motivating exercise experience for the user. Unfortunately, this exercise system is relatively expensive and incompatible with the user's existing exercise apparatus. With restricted ecosystem, the current VR-based exercise system in the market offers limited playable games. Unfortunately, such limitations are often less attractive to mass users. To address these limitations, the present invention responds by providing an affordable motion sensor system which is easily retrofittable to the user's own exercise ergometer, which transmits a continuous input to the user's mobile device. In order to continue playing, the user needs to exercise to avoid the dimming of the VR screen display which will occur correspondingly when no exercise movement is detected by ActiVRide sensor system. ActiVRide employs VR game converter technology, Trinus software, which enables users to conveniently convert their preferred game into VR compatible mode. Our pilot study data suggests that ActiVRide appears to be an effective, enjoyable, and motivating physical activity tool for the participants. The invention of such practical exercise system could potentially act as a tool to promote physical activity participation, particularly among targeted sedentary population and the growing gaming community.

***Keywords*:** virtual reality, gaming, exercise, sensor, motivation

INTRODUCTION

A rise in proliferation of tools related to virtual reality (VR) and its uses in various domains have been seen over the last decade. Currently, revolution in computer technology has literally made virtual reality (VR) inexpensive, prominent, and accessible. VR technology is interesting due to its boundless possibilities for the generation of stimuli, and helps users to be immersed in ecologically valid visual perception contexts. Consequently, this has helped the exponential application of VR into disciplines such as clinical, experimental and applied psychology. In sporting context, the most apparent advantage of VR is the ability to present stimuli in three dimensions, enabling sportsmen to train in the space of virtual environment.

The advanced technology in VR gaming system enables the users to have a three dimensional interaction with a computer-generated scenarios while involving the nervous system. Virtual reality (VR) has gained popularity in the gaming industry as it provides a real world experience. As the technology progresses, virtual reality systems are getting more affordable and accessible. Thus, its application is not solely for entertainment but also potential application in community settings (ie, patients' home). VR facilitates the stimulation of neuroplasticity of the brain with the interactive avatar movement which increases the rehabilitation intensity.

A small number of commercially available VR-based exercise gaming systems have been developed, but these systems require specialized equipment to operate. This consequently increases the overall cost of the system. The current VR-based exercise system in the market offers limited playable games and such a limitation, unfortunately, is often less attractive to mass users. In light of this, there is a clear need for affordable and flexible VR gaming systems, which could motivate users to exercise in an enjoyable manner while playing their preferred game. Therefore, the present invention aims to provide an affordable motion sensor system that could control VR display (dimming of display if no exercise is detected), and we hypothesize that this method will directly or indirectly motivate users to continue exercising.

METHODS

Few patents were awarded and designs for VR-based exercise gaming system have been proposed in the literature and industry, but none described specifically the current proposed system (Feldman et al., 1996; Jarvik et al. 1996 and Malafeew et al., 2016).

A. Proposed System

The proposed system consists of a VR headset, ActiVRide mobile phone application and sensor fusion system which are compacted in a touch screen enable shell that combines a 3D accelerometer, gyroscope and magnetometer sensor (to accurately measure the reciprocal velocity at a sampling rate of 50 Hz). ActiVRide sensor system provides control to the VR display. In order to continue playing the game, the user needs to continue exercising to avoid the dimming of the VR screen display when no exercise movement is detected by ActiVRide sensor system. ActiVRide employs VR game converter technology, Trinus software, which enables users to conveniently convert their preferred game into VR compatible mode (see Fig. 1).

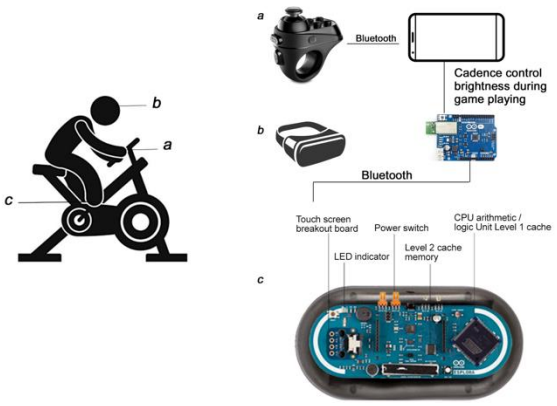

Fig. 1. Proposed ActiVRide System Flow

B. Feasibility Measures

Following the initial development of the basic prototype, a preliminary feasibility survey of the system concept was undertaken with a sample of 9 participants. Each participant's comments about the system were recorded. Any related details while the participants were using the basic prototype were noted by the researcher for discussion following the session. At the end of the session, participants' perception and experience of using the prototype were determined through series of post-study interview questions. Accuracy of exercise movement performance and VR visual display were analyzed.

RESULTS AND DISCUSSIONS

A. Feasibility of the Proposed Prototype

Following the completion of 3 sets of ~30 min trials, participants appeared to gain sufficient understanding on how to operate the system without any assistance from the researchers. The qualitative interview questions gave subjective information regarding participants' perception about the prototype, inspiration to utilize the prototype and particular criticism on potential changes to progress the existing framework. The majority (>85%) of participants were satisfied with the proposed system. Overall, participants reported the proposed system to be helpful, enjoyable and motivating. Specific comments related to the usability of the system were: "This is exercising made fun!" "It's an immersive system - I keep forgetting that I'm exercising" "It was good - it can be a good mind distraction for your workout."

CONCLUSION

In conclusion, the ActiVRide prototype system is designed as an affordable VR-based exercise gaming system, providing easily retrofittable sensor attachment to users' own exercise ergometer and controlling the VR display. It is a highly practical system where users only need to continue exercising whereby the dimming of the VR screen display will occur correspondingly when no exercise movement is detected. By employing VR game converter technology, Trinus software, ActiVRide users will be able to conveniently convert almost every game into a VR compatible mode. Initial assessment of the prototype suggested that ActiVRide appeared to be an effective, enjoyable, and motivating physical activity tool for the participants. Future directions in this research will be to fabricate, refine and commit to industrial designs towards a fully functional, market ready prototype for the proposed device. The ActiVRide exercise system could potentially be a tool to promote physical activity participation, particularly among targeted sedentary population and the growing gaming community.

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