Active Rehabilitation with Virtual Golf: Immersive and Virtual Player

Introduction & Problem Addressed

The software developed with **VR technology** provided by Oculus Rift and application of machine learning is a platform in the form of **a golf game** with the purposes of frozen shoulder rehabilitation.

The software will be developed with the aid of **Steam VR**, the Unity Engine for 3D game development, and the **open-source project VRTK**.

There are in total of two modes in the game. One is normal mode where the game will provide an **immersive simulation of the golf game**. Another is the rehabilitation mode, where user will be directed to **perform certain gestures and movements for the ease of frozen shoulder in a golf game context**.

[... movements to alleviate frozen shoulder ...]

Virtual Reality, by definition, is a computer technology that offers the user **immersive 3-D experiences constructed on computer visuals** (models etc.) and interactive elements for the users to explore. The features of the Virtual Reality can assist with various purposes, including learning and promote the rehabilitation of people with chronic joint diseases (Tania et al. 2017).

Games developed with VR technology provides rehabilitation clients from a wide range of variety with more **accessible enjoyable incentive for both exercises on a full-body scale and specific practices on particular body parts** (Levac et al. 2015).

Additionally, the interactions mechanisms embedded in the form of game motivating users' continuous usage and the real-time feed-back and analysis of users' body status and gestures, the process of the game itself **distracts the user from body pain, and the increased enjoyment together, added to the popularity of VR-based reha-**

Methodology

1. Steam VR

SteamVR is a **video game system with a receiver known as HTC Vive** that is constructed by Valve and partner HTC. just like the Oculus Rift, the Vive is a VR device that contains 2 screens (1080x1200 resolution) streaming data at high refresh rates (90Hz) to make the sense of virtual reality. [remove extra stop full.] ___ses that sit between user's eyes and the displays to make a rounded field of view and facilitate them to concentrate on the LCDs.

2. VRTK

VRTKis an **framework entitled of helpful scripts** to help building VR solutions quickly and easily in **Unity3d**.

3. Humanoid Avatar

Unity's Animation System has special characteristics for operating with humanoid characters. Unity provides a specialised workflow, **associated an extended tool set for humanoid animations because of the common humanoid characters in the game**.

The Avatar system told us how Unity spots a specific animated model humanoid in layout, and that elements of the model corresponding to the parts of the body.

Because of the similarity in bone structure between completely different humanoid characters, it's attainable to **map animations from one humanoid character to a different, permitting retargeting and in-**

Key Results

According to a recent study conducted by Institute of Sport Science, University of Regensburg, Regensburg, Germany (2016), not only specially constructed golf training, even r**egular golf training poses a positive effect on the mental performance, visual spatial abilities, and physical status to the stroke patients**.

Patients with chronic frozen shoulder and arm pain resulted from stroke tend to refrain from movement of arms due to the pain, which jeopardizes the recover process of the body, as clinical reports have shown **regular moving practices will enhance the arm conditions**.

We conclude that, the simulation of swinging a golf club in the context of a golf themed game could **serve as a routinely practiced medical treatment for diseases pertaining to, or affects arm movements, such as stroke and frozen shoulder**. Patients are able to follow a clinical-effective pattern of arm movements in the game.

In the software, a selectable humanoid model reflecting the body movement of the patients will be displayed while the game is in process. The humanoid model serves as **a movement reference to the patient for him/her to determine whether the current movement status fits the recreational purposes**.

The method the software adopted to generate the movement of the humanoid model is by inverse engineering, which is to analyse the movements and attributes of the VR sensors in patients' hands to generate the movement of the patient.

References
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