Non-Immersive VR Games for Upper Limb Rehabilitation Following a Stroke

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Introduction

Early stroke rehabilitation with Intensive and repetitive functional tasks shows positive outcomes [1]. The main difficulty is engaging patients and motivating them for physical therapy sessions. VR games are effective in engaging as well as motivating participants to practice more movements. Commercial off-the-shelf games may not be appropriate for the specific needs of stroke rehabilitation. Specific goal-oriented tasks, highly repetitive and intense therapy-tailored VR games can be suitable for rehabilitation [2].

Methods

We have developed a non-immersive VR games environment that may be particularly suitable for stroke patients, the architecture and its components are shown in Figure 1. The VR games does not involve any attachments so is non-immersive and based on recreational activities of daily living (ADL), developed using the Unity3D game engine. This development incorporates suggestions from clinicians and physiotherapists for upper limb rehabilitation. We developed four VR games based on indoor and outdoor activities and all use task-based scoring system.

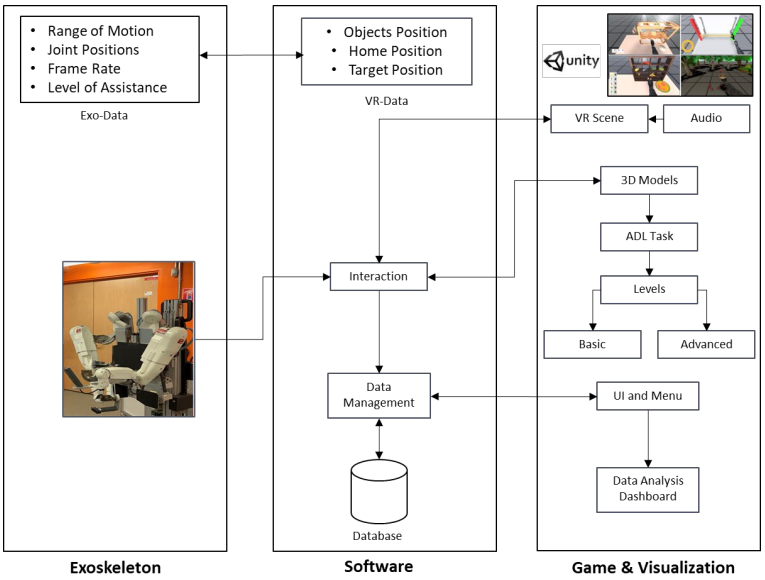

Figure 1: Development Diagram of VR Games for Stroke Rehabilitation

Results & Discussion

These games are interfaced with an exoskeleton robot that provides movement in assistive and free modes to play VR games. The design incorporates bilateral data transfer between the robot and VR games is exchanged through a bridge program we have developed. The whole operation of the rehabilitation system shows seamless and real-time data transfer for coordinated upper limb movement with the exoskeleton robot. We believe that such a system would be useful for hospitals and community centres where patients can receive longer sessions of therapy. The whole system can operate without much supervision.

Conclusion

VR games can create a safe and engaging environment that can be tailored to suit particular patients' requirements. Being non-immersive means patients are not overloaded with head-mounted displays and sensors, this is welcoming for patients and could significantly impact recovery compared to off-the-shelf commercial games. It also measures and records precise data than the standard physical therapy.

References

1. Burke, J.W. et al.: Serious games for upper limb rehabilitation following stroke. In: Proceedings of the 2009 Conference in Games and Virtual Worlds for Serious Applications, Washington, DC, USA, 2009, pp. 103–110.
2. Laver KE et al.: Virtual reality for stroke rehabilitation. Cochrane Database of Systematic Reviews 2015, Issue 2. Art. No.: CD008349. DOI: 10.1002/14651858.CD008349.pub3.