Serious Games for Upper Limb Stroke Rehabilitation
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Introduction:
Stroke rehabilitation plays an important role in recovering the lifestyle of stroke survivors. However, current stroke rehabilitations are facing numerous issues that may delay the patients’ recovery progress. One of the main issues is the lack of patient interest in performing the rehabilitation redundant tasks for long periods of time. They tend to lose their interest quickly and get distracted easily during the rehabilitation sessions. Additional issues with stroke rehabilitation in hospitals include the high healthcare cost since the treatment is often managed on a one-to-one basis, the travel expenses on patients, and the insufficient capacity of hospitals comparing to the large number of stroke patients. Therefore, many stroke patients were encouraged to continue their rehabilitation therapy at home. Unfortunately, statistics reveals that only few number of stroke patients perform the rehabilitation therapy at home as advised by their therapists.

Although existing research proved the engagement and effectiveness of non-immersive virtual reality (VR) based rehabilitation systems, limited research is available on the applicability of fully-immersive VR-based rehabilitation systems.

Objective:
In this study, we aim to examine the applicability of fully-immersive VR-based rehabilitation systems designed for domestic upper limb stroke patients.

Method:
For this purpose, we will develop and evaluate a fully-immersive VR-based rehabilitation system that allows stroke patients to perform the rehabilitation tasks more excitingly and enables healthcare providers to track their patients’ recovery progress remotely to suit the requirements of home-based rehabilitation. The proposed system will incorporate the use of Oculus Rift Head Mounted Display (HMD) and the Leap Motion hand tracker to achieve the highest level of patient excitement. To determine the proposed rehabilitation system contents and function we will distill the recommendation and best practices from previous work, in addition to interviewing and observing the specialists. The system will be developed using Unity VR development environment. Moreover, the system will be evaluated using system testing and user acceptance testing.

Expected Outcome:
The expected outcome of the study is raising the stroke patient engagement and motivation to continue their rehabilitation therapy and provide a great and cost-effective solution for home-based rehabilitation.

Conclusion:
To the best of our knowledge, none of VR-based rehabilitation systems was provided in Arabic language or has been examined in Saudi Arabia environment. This study is an ongoing research, thus the conclusion is not clear yet. However, the current limitations of the proposed system are the following:
• The system will contain one rehabilitation game, which is inspired by some of the arm rehabilitation movements. Hopefully other set of games will be provided later to cover all the rehabilitation movements.
• Unfortunately, clinical pilot study is not possible in this study due to the time constrains. However, it will be one of this research future plans.

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