Android Effect Based Serious Games for Stroke Rehabilitation

Priti Madhukar Mithari[1]
DYPIET,AMBI
Pune, India.

Abstract

Stroke has been a very common disease for middle and old aged people that causing disability and a range of impairments. But, somehow this stroke tends to change a patient's life in a drastic way and so to make their lives easier we have been trying to make rehabilitation in their conditions. This Rehabilitation of patients is done with the help of serious gaming. Using computational techniques the home based rehabilitation has been safe and effective. This paper discusses about the rehabilitation of a stroke patient by playing serious games. This system focuses on the monitoring of the player's actions through games including the wrong actions which degrade the rehabilitation process. This system is based on a game which will lead to some small betterment in the patient lives. The system explains about the rehabilitation of a stroke patient by playing games. So to make a better use of gaming rehabilitation technology not just for the younger ones, but also best for the old age people.

Keywords - *Adaptation, Gaming, and Ischemic strokes Introduction*

I. INTRODUCTION

STROKE has been one of the most common diseases till now all over the globe. Nowadays, due to stress and other toxic impact on human beings it is common for old age people. It has led to two types of strokes 1) Ischemic strokes and 2) Hemorrhagic strokes. The stroke directly attacks on the brain when the blood is not reached to the blood cells, it causes an attack and can damage and part of the body or it can paralyse it or how to communicate effectively when their ability to use language has been compromise It can be treated through proper treatment under the supervision of doctors and then the rest of the rehabilitation is carried out by the therapists. Usually there are two phases, 1) during the initial phase, the patient is hospitalized and is taken care of in the hospital and 2) another phase is based on the exercise of the patient for a long time, after getting out of the hospital. So whenever any person suffers through stroke there are two types of rehab- 1) Brain injury rehab and 2) post-acute rehab. Firstly the patient is treated completely under medication and hospital. But after that post-acute rehabilitation happens, the post-acute rehab phase is determined by

the severity of the stroke and the brain injury related deficits.

But for the rehabilitation phase, the patients need to go to specialized centre for daily sessions to the therapist. Given the increasing number of stroke patients and the increased cost of rehabilitation, the outpatients are being progressively shrinking. Some of the patients, who can afford such prolonged session, drop it in the middle due to its high prices. This stops the improvisation of their health and it returns to the previous stage. This is where the need of home rehabilitation comes into the picture.

The rehabilitation at home can be done in many ways. Traditionally rehabilitation at home had limited resources which led to an ineffective approach. So to make this approach a better approach, the exercise will be supervised by the clinicians and the therapists. Just like tracking of the patients motions to evaluate the performance of the patients using the log. Until recently, this was only possible, restoring to motion capture technology because of its cost, complexity, and maintainability, are more suited to hospital rather than patients' houses [1].

So after all these rehabilitation processes the patient mostly feels more disable and so here we have a concept of Rehabilitation through gaming. Through games we can rehabilitate the upper-limb, lower-limb, and also left-right brain. For example, the left hemisphere controls language. So if you have a left-brain stroke, then you might have difficulty speaking and understanding language (a condition known as aphasia). After all, it's all about the brain and not about the body. Brain knows how to heal itself. So by using games, exercises and other ways a stroke patient can always find a way out there to be at their own.

So the main goal has been made to motivate the patients and also to have engaging sessions for them. The feedback can be real-time and even the low-cost rehabilitation would be affordable for the patients. These goals are not so easy to achieve as there are many games in the market but only few games supports the rehabilitation.

The intelligent and android games had come out with more interesting 3D and 2D games supported by the devices supported by high end 3D devices and any handheld devices.

II. RELATED WORK

In the past years, the many research has proposed so many new rehabilitation technique at the hospital as well as home. All the researchers agreed with rehabilitation application (i.e., games) should be adapted to the actual status and capability of the patient. The difficulty level of the game should be maintained. Moreover, there are lots of games available in the market, but not all of them support rehabilitation only few of them are suitable for it. So the related work on rehabilitation of patients is done in a very proper way and to handle it efficiently.

Michele Pirovano, Renato Mainetti, Gabriel Baud-Bovy, Pier Luca Lanzi and N. Alberto Borghese, Proposed "Intelligent Game Engine for Rehabilitation (IGER)" [1], this is basically based on the IGER module which is divided into two parts one is the game engine and another is the virtual therapist. In this system the patients plays the games and the virtual therapist captures the motion of the patients and send feedback according to it. It also makes the difficulty level of the game easily and slowly higher. The functionalities of these games are: input data, animation, and collision detection, rendering and game logic. A configuration is set purely on the basis of a patient's status. There are 11 games support rehabilitation through high-end 3D devices and this made the supervision of rehabilitation better than before.

Michele Pirovano, Renato Mainetti, Gabriel Baud-Bovy, Pier Luca Lanzi and N. Alberto Borghese, Proposed "Self-adaptive games for rehabilitation at home" [4], which explains about the Games developed for the rehabilitation and a hierarchical platform for rehabilitation at home, which was taken under the Rewire project [5], this platform had helped a lot through its low-cost oriented platform. This platform consists of three components: a patient station (PS), a networking station (NS) and a hospital station (HS), The PS has four modules which are – a hospital communication module, a lifestyle module, a community module and IGER module. Here they have mentioned about one of the self-adaptive games, i.e., Fruit Catcher. In this paper they have mainly focused on the continuous adaptation of the game and monitoring of the patients' actions so that new games can be generated based on this study.

Gustavo Saposnik, Robert Teasell, Muhammad Mamdani, Judith Hall, William Mcllroy, Donna Cheung, Kevin E. Thrope, Leonardo G. Cohen and Mark Bayley, proposed "effectiveness of virtual reality using Wii gaming technology which is used in stroke rehabilitation. A pilot randomized clinical trial and proof of principle [5] discusses about the rehabilitation of stroke patient through Wii Gaming. This is a type of pilot, randomized, single-blinded trial has taken place for 2 months, and they compare the feasibility and safety. Through this treatment the results were 8 out of 10 in the recreational therapy for arm and 9 out of 10 for participants in VRWii. Accordingly, the VRWii gaming technology has been a safe, feasible, supervised and the fast development rehabilitation.

Dajana Dimovska, Patrick Jarnfelt and Shebbe Selving have proposed "Towards Procedural Level Generation for Rehabilitation" [6], has developed a game for rehabilitation named as Ski-Slalom on Wii balance board for patients with injured leg. As it has been challenging to develop a game with the help of Wii balance board, as the games played on this board are usually not applicable for the rehabilitation. So to introduced procedural content generation (PCG) this challenge can be solved.

J. W. Burke, M. DJ. McNeil, D. K. Charles, J. H. Crosbie and S. M. McDonough has proposed "Serious games for upper limb rehabilitation following stroke" [7]. This paper discusses about why entertainment can be a much effective way for the rehabilitation of instances and to engage the patient. The games are developed in consideration for the technology the virtual environment can be safe, customized and engaging for the patient. As a patient gets stroke 66% of the upper limb is affected due to it. As a result, the rehabilitation of upper limb can be done through serious gaming rehabilitation. The games were 80% effective, according to the feedback. 57% found that the input devices were very engaging and 90% of them found it easy to use. This games gave an efficient feedback and more game design can be implemented further.

III. SYSTEM ARCHITECTURE

In order to demonstrate that Serious Games can be used to increase motivation of patients in rehabilitation, a framework was developed for Serious Games in Health Rehabilitation that integrates the set of features identified as relevant to improve the rehabilitation process, such as: natural and multimodal interaction, social skills (collaboration and competitiveness) and progress monitoring. Fig.1 [1] shows the system architecture for serious game for health rehabilitation. The architecture divided into several distinct layers of input recognition.

Layer one represents input modalities in raw form. Layer represents an abstract recognition from the inputs received in raw form.

In Layer three we can see a combination/fusion of more modalities among each other: gesture recognition, emotion recognition, representing higher levels of recognition processes.
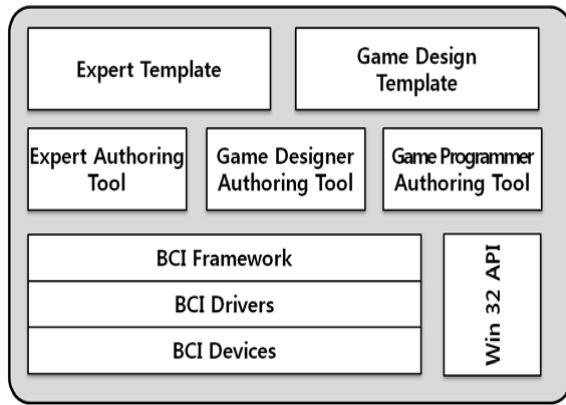
Fig.1 System Architecture

IV. CONCLUSION

There are few strokes in which even by playing an android game based on rehabilitation of patient. This is the simplest ideas as the patient itself can identify about its level of adaptation which makes them realize about their health. Patient can apply for this rehabilitation according to their conditions. So, even playing an android game can repair your brain and makes the patients disability decreased. The High-end 3D games have supported the autonomous rehabilitation at home with the support of IGER functionalities. The rehabilitation has got more dynamic, safe and effective. It controls the computational intelligence methods, providing the monitoring of game play and the player action and also to maintain the difficulty level of the games, so that the result is effective. Moreover, the devices which are used are low-cost tracking devices.

ACKNOWLEDGMENT

REFERENCES

[1] Michele Pirovano, Renato Mainetti, Gabriel Baud-Bovy, Pier Luca Lanzi and N. Alberto Borghese, "Intelligent Game Engine for Rehabilitation (IGER)", vol. 8, no. 1, pp.43-55, March 2016.

[2] R.Clark, Y. Pua, K. Fortin, C. Ritchie, K. E. Webster, L. Denehy, and A. L. Bryant, "Validity of the Microsoft Kinect for assessment of postural control," Gait Posture, vol. 36, pp. 372–377, 2012

[3] R.Clark, A. L. Bryant, Y. Pua, P. McCrory, K. Bennell, and M. Hunt, "Validity reliability of Nintendo Wii Balance Board for assessment of standing balance," Gait Posture, vol. 31, pp. 307–310, 2010.

[4] M.Pirovano, R. Mainetti, G. Baud-Bovy, P. L. Lanzi, and N. A. Borghese, "Self-adaptive games for rehabilitation at home," in Proc.IEEE Conf. Comp. Intell. Games, 2012, pp. 179–186.

[5] G.Saposnik, R. Teasell, M. Mamdami, J. Hall, W. McIlroy, D. Cheung, K. E. Thorpe, L. G. Cohen, and M. Bayley, "Effectiveness of virtual reality using wii gaming technology in stroke rehabilitation a pilot randomized clinical trial and proof of principle," Stroke, vol. 41, pp. 1477–1484, 2010.

[6] D.Dimovska, P. Jarnfelt, S. Selving, and G. Yannakakis, "Towards procedural level generation for rehabilitation," in Proc. 2010Workshop Proc. Gen. in Games, 2010, pp. 7:1–7:4. PIROVANO et al.: INTELLIGENT GAME ENGINE FOR REHABILITATION (IGER) 55

[7] J.W.Burke, M. McNeill, D. Charles, P. Morrow, J. Crosbie, and S.McDonough, "Serious games for upper limb rehabilitation following stroke," in Proc. Games Virtual Worlds Serious Appl., 2009, pp.103–110.