Android-Based Games for Stroke Rehabilitation

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Abstract— **Stroke has been one of the most common diseases till now all over the globe. 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. So, here we are going to discuss the problem of rehabilitation in the current scenario of gaming precept. Our proposed system is based on a game which will lead to some small betterment in the patient lives. We are going to discuss about the rehabilitation of a stroke patient by playing games. So to make a better use of technology not just for the younger ones, but also was the old age people this gaming rehabilitation is best.**

Index Terms— **Adaptation, Gaming, Ischemic strokes**

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I. INTRODUCTION

Stroke has been a great cause of human health. Nowadays, due to so much stress and other toxic impact on human beings. It has lead to two types of strokes 1) Ischemic strokes and 2) Hemorrhagic strokes. The stroke directly attacks 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 paralyze it or or how to communicate effectively when their ability to use language has been compromised. 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 completed 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. 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 sensory organs. So if you have a left-brain stroke, then you might have difficulty speaking and understanding things (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 on their own.

II. MOTIVATION

This research is to motivate the patients and also to have engaging sessions with them. The feedback is real-time. It is also not much expensive anyone can afford it and also maintain their routines easily at home itself. These goals are not so easy to achieve as there are many games on the market, but only few games support the rehabilitation. The android games had come out with more interesting 2D games supported by the devices supporting any handheld devices.

III. BACKGROUND

1. "Intelligent Game Engine for Rehabilitation (IGER)"

Michele Pirovano, Renato Mainetti, Gabriel Baud-Bovy, Pier Luca Lanzi and N. Alberto Borghese, proposed IGER (Intelligent Game Engine for Rehabilitation) module which was divided into two parts. One was game engine and the other was virtual therapists. In this architecture 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.

2. "Self-adaptive games for rehabilitation at home"

Michele Pirovano, Renato Mainetti, Gabriel Baud-Bovy, Pier Luca Lanzi and N. Alberto Borghese introduced a concept of rehabilitation at home using self-adaptive game which means to automatically increase the level of the game with respect to the performance of the patients. It has three module Hospital station, Network station and Patient station. This setup is made up by the clinicians.

3. "Effectiveness of virtual reality using Wii gaming technology in stroke rehabilitation-A pilot randomized clinical trial and proof of principle"

Gustavo Saposnik, Robert Teasell, Muhammad Mamdani, Judith Hall, William Mcllroy, Donna Cheung, Kevin E. Thrope, Leonardo G. Cohen and Mark Bayley discusses about the Wii-gaming technology used in stroke rehabilitation. It was a case study for 2 months and they had got 9 out of 10 participants for Wii-gaming. It is a randomized single-trial.

4. "Serious games for upper limb rehabilitation following stroke"

J. W. Burke, M. DJ. McNeil, D. K. Charles, J. H. Crosbie and S. M. McDonough introduced most of the cases while a patient is suffering from stroke 66% of its upper limb body can get damaged. To recover this serious gaming can be used as a solution to this problem as it makes 88% of the body recover through this rehabilitation process.

IV. KOTLIN TECHNOLOGY
a) Kotlin

- Kotlin is a new open source programming language like Java, JavaScript, etc. It is a high level strongly statically typed language that combines functional and technical part in a same place. Currently, Kotlin targets Java and JavaScript. It runs on JVM.
- Kotlin is influenced by other programming languages such as Java, Scala, Groovy, Gosu, etc. The syntax of Kotlin may not be exactly similar to JAVA, however, internally Kotlin is reliant on the existing Java Class library to produce wonderful results for the programmers. Kotlin provides interoperability, code safety, and clarity to the developers around the world.

V. PROPOSED ARCHITECTURE:-
Architecture for Serious Games for Health Rehabilitation:-

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. Figure 1 presents the architecture diagram. The architecture, comprises several distinct layers of input recognition. The first layer represents input modalities in raw form. The second layer represents an abstract recognition from the inputs received in raw form. In the third layer we can see a combination/fusion of more modalities among each other: gesture recognition, emotion recognition, representing higher levels of recognition processes.
The main modules of the architecture are:

a. Game Engine: is the game component that is most common to all games,representing the most generic component of the game logic.

b. Game Database: the most specific component of the games that represents therepository of all the games that are available for use in the rehabilitation session.

c. Social Networking: this module is responsible for creating the mechanisms forusers (patients) to group together in social networks in order to communicate witheach other and providing tools to mediate and facilitate social interactions.

d. Competition/Collaboration: responsible for creating the interaction mechanisms ofcompetition and collaboration among users. It includes user modelling and profilingArchitecture for Serious Games in Health Rehabilitation 313for establishing the handicaps with which each user will play with others, even if atdifferent levels of the rehabilitation process.

e. User Management and Profiling: responsible for managing the informationassociated to the users, including their profiles, therapies they have to follow, state ofthe therapy, progress indicators, handicaps, etc.

f. Logging & Monitoring: module responsible for registering the user logs, session duration, last difficulty level attained in each session in order to monitor the progressof each patient during the therapy.

This architecture has developed a mobile application (Game) called Block Bunny.
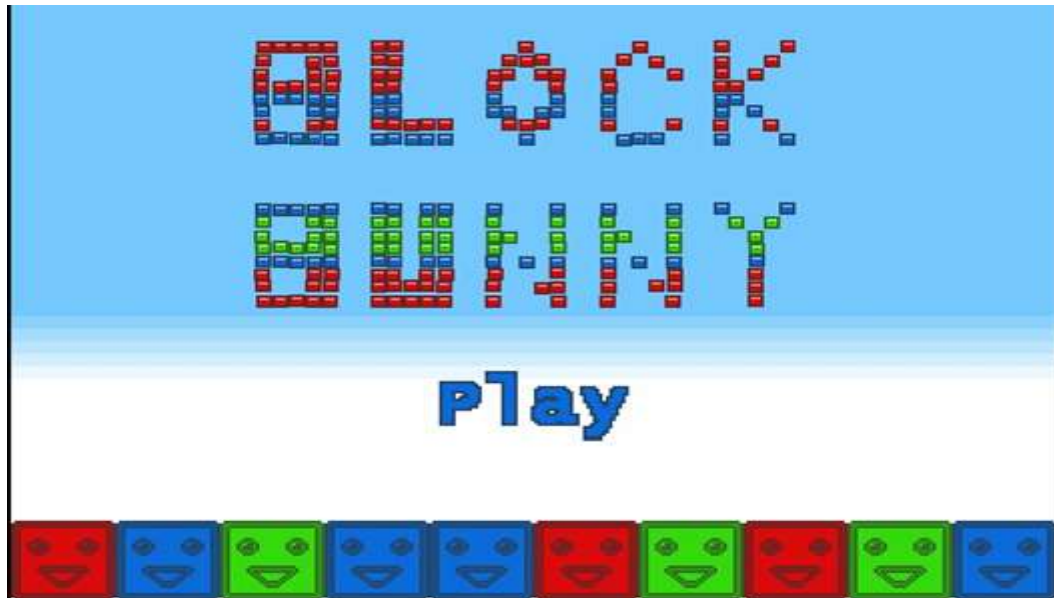

Fig.1 Snapshot of Game bunny called Block Bunny.
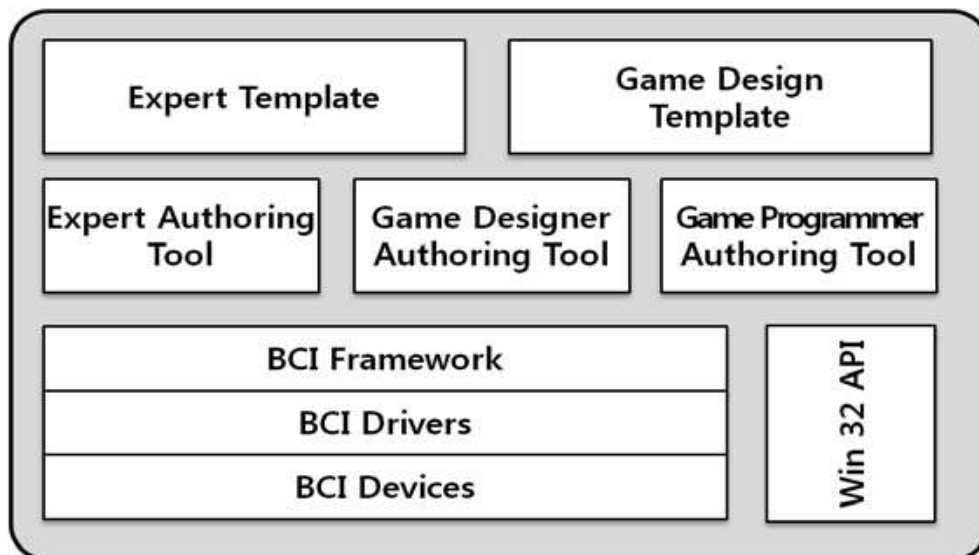
Fig.2 Snapshot of Screens of Games.

Fig.3 Architecture of Rehabilitation of Gaming.

a. Virtual Players: module responsible for defining the agents that will assume the responsibility of users/players in the application sessions. This will enable some multi-player games even with only one real user.

b. Therapist Manager: provides a set of tools to configure, monitor and analyse the configuration of the prescribed therapy (the games that each patient will play, the duration of the sessions, the progress, etc.)

c. Input Modality Manager: manages the different input modalities and it can be adapted to the different disabilities of the users. It can be decomposed in two levels of recognition: in a mid-level we have individual forms of recognition: facial expressions, voice/speech, BCI/Biofeedback, motion tracking, Haptic and torch/multi-touch. In a higher level we can have a fusion of some of the modalities present in the mid-level that could compose a module of emotions recognition or 314 P.A. Rego, P.M. Moreira, and L.P. Reis gestures recognition, for example. The machine interpretation of human behaviour is very important in HCI, for achieving natural forms of interaction. In a mid-level recognition, users can communicate or interact with the machine by several forms that need to be interpreted by the machine. Users can convey messages in the form of body gestures, facial signals, speech, and emotions, among others. In a higher level of recognition, gestures recognition systems can have a multimodal nature, representing a fusion of the different input modalities present on the mid-level: gestures can be translated in: hand gestures; or body positions and movements that control a virtual environment on the screen, being captured by cameras or by the use of data sense gloves; or they can be a sequence of finger positions and movements in a multi-touch table; or they can be face gestures. Emotions have also a multimodal nature. They can be expressed through several modalities (and channels) of the mid-level recognition module: verbally by the use of emotional vocabulary or by expressing several nonverbal cues such as facial expressions, voice intonation, postures, gestures, and physiological changes. The decoding of these cues is essential to interpret the correct message. It is therefore necessary in a multimodal system to make a fusion of these different modalities to achieve a reliable (accurate) assessment.

d. Output Modality Manager: manages the different output modalities. It can include a display, sound device, haptic device and force-feedback equipment and it can be adapted to a specific game, environment or user. The platform of the architecture provides virtual player and competition/ collaboration modules that integrate with the social/users community component (social network).

VI. DESIGNING GAMES FOR REHABILITATION

Commercial games currently available on the market are not suitable for patients that are typically impaired and in the 60-70 age range: their fast interaction pace and the wealth of targets and dis tractors make usability low and may produce strain and anxiety. Therefore, games specifically targeted to rehabilitation have been developed. Unfortunately, most rehabilitation games developed so far are focused on the clinical constraints and did not take into account the well-known design principles used in most commercial games. As a result, rehabilitation games generally lack the appeal of commercial games because of their limited graphics and gameplay. In contrast, we believe that both clinical and design aspects should be considered to deliver compelling and engaging rehabilitation games which, ideally, people might want to play even if they do not have to. This might increase the emotional connection between the patients and their family members. In this work, we aim at increasing patients' involvement by developing games that follow the best practices of game design, provide attractive graphics, and can create an engaging rehabilitative experience, hiding the burden of therapeutically repetitive tasks under the hood of compelling fantasy. Our goal is twofold. On the one hand, we want to create games that are effective for therapeutic purposes and result in successful rehabilitation. On the other hand, we want games to be compelling, since patients must typically play them on a regular basis. We address our first goal through a tight collaboration with unfilled caretakers and by collecting as much feedback as possible from patients and therapists. We address our second goal by leveraging state-of-the-art game design theory, which takes into account several principles, including formal and dramatic elements, the interest curve, flow theory and the sense of presence.

VII. SOFTWARE & HARDWARE REQUIREMENTS

The environment setup required:-

Operating System :-	Windows, Linux
Processor:-	Intel i3
Memory:-	50GBHDD

- Internet connection Required
- Android device for testing.

VIII. CONCLUSION

The conclusion of this implemented concept is that there are few strokes in which even by playing an android game based on rehabilitation of patient. This is the one of 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. We would conclude that even playing an android game can repair your brain and makes the patients disability decreased.

IX. ACKNOWLEDGEMENT

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