



INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 4.295

(Volume 4, Issue 2)

Available online at: www.ijariit.com

Interactive physiotherapy

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ABSTRACT

Technological progress made in the field of computer science with the passage of time have become ever-present in the lives of the majority of people. This form of progress can also be used in medical rehabilitation as an interactive game based physiotherapy. Physical therapy is always a big part of rehabilitation, but as time goes by, patients tend to get tired and demotivated due to repetitive and tedious exercises. It's hard and time-consuming to book an appointment with a good physiotherapist. So, an interactive motion detection system with the help of Kinect can be a boon to this problem. It works as a mirror because it helps patient in the perception of moments offering a visual feedback. The use of interactive physiotherapy makes the treatment more encouraging, stimulating the human senses (mainly body movements).

Keywords: Kinect Sensor, Physiotherapy, Rehabilitation.

1. INTRODUCTION

Rehabilitation and physical therapy are optimal when assessment, monitoring, adherence to the therapy program and patient engagement can be achieved. In traditional physiotherapy and rehabilitation practice, different kind of physical exercises are involved. These processes are usually intensive, time-consuming, depends on the expertise of the therapist [1,2], and implies the collaboration of the patient who is usually asked to perform the therapy multiple times at home with no supervision. A stroke is a result of interruption of the blood supply to a particular area of the brain, which is caused due to blockages in blood vessels. This cuts off the supply of oxygen and nutrients leading to cell injury and cell death. It is responsible for one death every 6 seconds, and the chance of having a stroke approximately doubles for each decade of life after age 55[3]. Sometimes, this condition can also affect young adults and teenagers. Stroke is a significant risk factor with age and the need for new rehabilitation is in demand. Technology and its advanced methods are continuously being assessed so that they can be used in medical rehabilitation as an interactive game based physiotherapy. This area of rehabilitation technology is expected to expand and will do so over the coming years. The Microsoft Kinect sensor incorporates several advanced sensing hardware. Most notably, it contains a depth sensor, a color camera, and a four-microphone array that provide full-body 3D motion capture, facial recognition, and voice recognition capabilities. Microsoft Kinect can allow the patients to interact with the system, where they perform multiple movement combinations without the need of an attached device or a controller. A Kinect-based system can facilitate proper performance of rehabilitation exercises, increase patient accountability, allow the clinician to correct errors in exercise performance.

2. LITERATURE SURVEY

Increase in no. of cases of stroke is a challenge for physiotherapy, hence innovative and interactive ways for physiotherapy exercises are required. In clinical settings and experimental studies of muscular disorders, participants emerged in interactive physiotherapy

experience reduced the level of pain, general distress/unpleasantness and report a desire to use gesture recognition again during painful medical procedures of this kind.

Carlo Camporesi, et, al [1], The authors proposed a new solution based on Virtual Reality technologies for improving the delivery of physical therapy and rehabilitation. Three main aspects are addressed: 1) the ability to allow therapists to create new exercises and therapy programs intuitively by direct demonstration, 2) automatic therapy delivery and monitoring with the use of an autonomous virtual tutor that can monitor and quantitatively assess the motions performed by the patient, and 3) networked collaborative remote therapy sessions via connected applications displaying the motions of both the therapist and the patient.

Grigore Burdea, et, al [4]. Virtual rehabilitation represents the provision of therapeutic interventions locally or at a distance, using Virtual Reality hardware and simulations. Such therapy has been applied to various patient populations, including muscular-skeletal, post-stroke, and cognitively impaired. This paper reviews the benefits brought by VR-enhanced and VR-based rehabilitation to the above patient groups. Also discussed are the many challenges in integrating this new technology into the medical care system.

Juraj MIHAL'OV et, al [5]. A few years ago, the world has experienced the birth of a new approach to the game controls. Although the classic mouse & keyboard configuration will not be beaten so easily, the new motion-sensing controllers bring the gaming to a whole another level. The purpose of this publication is to bring a general information about Kinect, its history, and future as well as its bright and dark sides.

Mateus Trombetta, et, al [6]. They propose a serious game for post-stroke rehabilitation with six different levels of exercises. This solution allows to assist the traditional therapy and motivate the patient to execute his/her rehabilitation program, under health professional supervision. A preliminary study shows good results in user preferences. This approach supports first- and third-person point of views and virtual reality devices, like head-mounted displays and motion sensors.

JUNGPIL SHIN¹, (Member, IEEE), et, al [7]. The paper proposes an aerial keyboard system. As aerial keyboards are very time consuming and difficult to detect, they proposed a system that can use hand tapping gestures for Japanese hiragana and English characters. This will facilitate human-machine interaction. In order to detect accurate motions and gestures the system will use Microsoft Kinect sensors. By using this, users can interact with computers using their non-touch input system.

3. PROBLEM DEFINITION

The traditional approach in medical science for physiotherapy is now been in practice for years and it's been very tedious for the instructor and boring for the patient. Effective stroke rehabilitation is dependent on patients performing their exercise programs continuously. Due to the repetitive, tedious and time-consuming exercise programs in traditional physiotherapy, the patient tends to lose interest and gets tired. To solve this problem, a new concept of motion detection using Kinect can be used for physiotherapy in a way which patient may find interesting. Hence using this concept, Interactive Physiotherapy System using Microsoft can be developed to offer innovative and exciting ways to rehabilitate, making treatment more enjoyable thus increasing motivation and therefore adherence. This is an important area for physiotherapists to develop their skills in, as technology is beginning to thrive in the health sector and is becoming a part of therapy treatment options. In addition, it reduces workload by utilizing physiotherapy time effectively while still providing therapy. Objectives of this project are: 1) To improve mobility and strength and to help reduce the pain that patients might suffer due to an injury or disability, 2) To develop interactive and suitable games using Unity3D to perform physiotherapy exercises, 3) The system should provide updated information about the progress that will update their respective doctors with accurate results, 4) Develop a profile based system to keep track of every individual's activity.

4. PROPOSED WORK

Interactive Physiotherapy will allow patients to perform different sets of therapy exercises in the form of interactive games. Monitoring and progress tracking improves patient understanding, motivation and helps in engaging more in these activities. The presented system can be implemented by Microsoft Kinect interfaced by unity3D.

The patient will perform different sets of therapy exercises in the form of interactive games. Movements of which will be captured by the Kinect Sensor and according to that the score will be set. This score will be monitored by a doctor to see the patient's progress and also to prescribe the new level of exercises. The overall data of the patient can be used for future recovery reports and profile analysis.

The following methodology has been proposed for implementing the proposed modules:

1) Registration Module

It involves simple database manipulation and will be incorporated into the system using simple PHP scripting. The registration form will be part of the front end of the application. Database manipulation will be done using MySQL.

2) Login Module

Involves simple database manipulation and will be incorporated into the system using simple PHP scripting. The module will form one of the main index page components and is indispensable for the use of the application. It will also be part of the front end of the application. Database manipulation will be done using MySQL.

3) Mapping of exercises

The games will be mapped to different types of exercises depending on the patient's requirements.

4) Game Development

Unity is a game development tool with a set of resources for the rapid development of interactive 3D or 2D applications using C#. Unity3D can be used for developing physiotherapy exercise based interactive games.

5) Microsoft Kinect Connectivity

Kinect is a device that recognizes body movements through a camera with RGB video detection; a depth sensor; an infrared sensor to capture spatial changes; and a microphone for voice commands. This way, it is possible to capture and map the patient movements during the game.

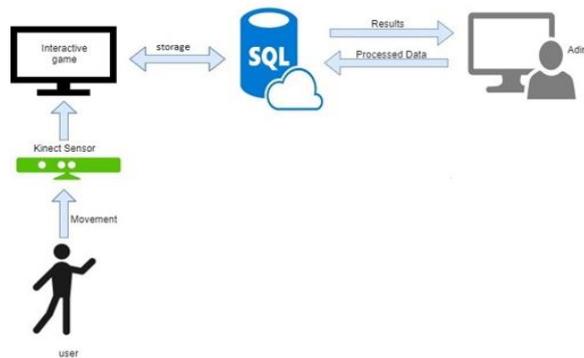


Fig 1 System Design

Fig. 1 illustrates the system design for interactive physiotherapy. The physiotherapist will prepare rehabilitation program for the patient and the processed data will be transferred and displayed on the monitor screen. The patient's body movements will be captured by the Microsoft Kinect sensor. The Microsoft Kinect sensor will forward the refined data to the computer. The reports will then be generated and will be stored in the database for further monitoring which will help to track patient progress.

5. CONCLUSION

Microsoft Kinect is a device which can be utilized to allow interactive rehabilitation differing from conventional therapy in its ability to provide more innovative and exciting ways to rehabilitate. Kinect based games for rehabilitation can increase motivation by offering a rich and distinctive environment for the patient. It can also allow networked sessions for rehabilitation where clinicians will still be able to monitor patient progress. The Kinect is continuing to advance, update and develop into a very feasible option for rehabilitation in the stroke population. The directions for future work are vast and have promised to enhance elderly care; stroke patient motivation to accurately complete rehabilitation exercises, rehabilitation record keeping, and future medical diagnostic and rehabilitation methods.

6. REFERENCES

- [1] Carlo Camporesi, Marcelo Kallmann, Jay J. Han. VR Solutions for Improving Physical Therapy, In Proceedings of IEEE Virtual Reality, Orlando, Florida, 2013.
- [2] Professor. Wanda Stryla, Journal of Neurology and Neuroscience, Physical Education Academy named Eugeniusz Piasecki in Poznan, Poland, 2015.
- [3] WHO - World Health Organization. Stroke, Cerebrovascular accident: Health topics. Geneva, 2013. [Online]. Available :< who.int/topics/cerebrovascular_accident/en/s>. [2 Oct. 2017].
- [4] Grigore Burdea, Virtual Rehabilitation Benefits and changes, CAIP Center, Rutgers University, USA, 2003.
- [5] Juraj MIHAL'OV, Kinect: From Entertainment to Scientific Research on Virtual Movement, Technical University of Košice, 2016.
- [6] Mateus Trombetta, Patricia Paula Bazzanello Henrique, Manoela Rogofski Brum, Eliane Lucia Colussi, Ana Carolina Bertoletti De Marchi, Rafael Rieder, Motion Rehab AVE 3D: a VR-based exergame for post-stroke rehabilitation, Computer Methods and Programs in Biomedicine (2017).
- [7] JUNGPIIL SHIN, (Member, IEEE), AND CHEOL MIN KIM School of Computer Science and Engineering, The University of Aizu, Fukushima, 965-8580, Japan 2 Department of Computer Education, Jeju National University, Jeju, 63243, Korea, Non-Touch Character Input System Based on Hand Tapping Gestures Using Kinect.