



Multidisciplinary production of interactive environments to support occupational therapies



Héctor Cardona Reyes*, Jaime Muñoz Arteaga

Universidad Autónoma de Aguascalientes, Aguascalientes, AGS, Mexico

ARTICLE INFO

Article history:

Received 26 February 2016

Revised 2 August 2016

Accepted 3 August 2016

Available online 3 August 2016

Keywords:

Interactive environments

Disability

Occupational therapy

Activities of daily living

Rehabilitation

MDA approach

ABSTRACT

This work focuses on proposing a multidisciplinary production of interactive environments as a technological support for rehabilitation of people with physical disabilities attending occupational therapy. Nowadays, some technologies and methods are used to develop software in order to assist the people who suffer some kind of physical disability but the physical therapies aren't limited to only one technique of rehabilitation. Current work promotes establish a multidisciplinary team such as therapists and technologists, they can collaborate for the production of interactive environments according the evolution of every patient's rehabilitation. The performance of current proposal is presented throughout a related work and a case study with several usability evaluations.

© 2016 Elsevier Inc. All rights reserved.

1. Introduction

Disability is a human condition by which we can all get through, either by an accident at work, illness or reach senility. Some data from the World Health Organization (WHO) shows that over one billion people, i.e. 15% of the world population suffers some form of disability, 2.2% of that population has significant difficulties to do everyday tasks [1], that without regard to disability rates increase due to aging and suffering of chronic diseases. These health problems are linked to disability which carry serious needs of assistance to be covered, consequently, services are required to enable enjoyment of the highest attainable standard of health [1]. Actually there are several techniques and methods as a means of rehabilitation help mitigate disability, one of them is occupational therapy, which the World Federation of Occupational Therapists (WFOT) [2] defined as a profession concerned with promoting health and well-being through occupation or activities such as Activities of Daily Living (ADL) in order to help people with physical, developmental, or emotional, to lead independent, productive and satisfying life [3].

Occupational therapy provides the knowledge and techniques for working with individuals or groups of people who suffer

involvement is a body-structure or function due to a change in health, and therefore makes experience limitations on their participation. Occupational Therapy is exercised in a variety of policy areas, including hospitals, health centers, private homes, workplaces, schools, reformatories and nursing homes. Patients are always involved in the therapeutic process and its results are diverse in nature, aimed at the patient and measured in terms of participation or satisfaction derived from participation. Taking into account the needs of rehabilitation is important to have strategies to reduce the long-term impact for which the patient suffers therapeutic process rehabilitation.

This work proposes a multidisciplinary production to produce interactive software environments in order to assist the evolution of a therapeutic rehabilitation of a patient, then environments could collect the data involved in therapeutic process, organize this information for the therapists in order to formulate a set of solutions for the patient. This work also promote specify the expert's knowledge in occupational therapy, the expectations of rehabilitation specialist and the patient, throughout the identification of best practices available in occupational therapy such as the activities of daily life. Then the specification of this available knowledge allows to design of new interactive environment which could provide better solution for patients. This paper is divided among seven sections. Next section discusses related work advocating the use of technologies to support the process of rehabilitation of persons with disabilities. Problem outline section focuses on describing the difficulties and problems to be solved in order to incorporate

* Corresponding author at: Universidad Autónoma de Aguascalientes, Av. Universidad #940, 20131 Aguascalientes, AGS, Mexico.

E-mail addresses: k6550g@gmail.com (H. Cardona Reyes), jmauaa@gmail.com (J. Muñoz Arteaga).

these interactive environments of therapeutic rehabilitation process. Following section describes the proposed multidisciplinary production and the necessary foundations for the production of interactive environments. A case study section is presented with some developed interactive environments used to support the therapeutic process patients with disabled hands attending the DIF of Aguascalientes, Mexico. Finally, last section presents the results of user experience and usability test.

2. Related work

In the literature there are related works that give a certain support to rehabilitation process (see Table 1). For this they preconize the use of some approaches such as video games, virtual reality, and mechanical appliances. In general, most of these proposals don't give details of production process, or just display partial information; many of these proposals we can find as a black box which focus on only part the therapeutic process.

This related work has been analyzed and compared them (see Table 1). They used several platforms such as Opti-Track camera, Kinect, and Wii. In general, most of these proposals give feedback to user and the open production is not offer. Notably, related work don't specify a clear support for a multidisciplinary production of interactive environment to manage the patient's rehabilitation.

3. Problem outline

Rehabilitation therapies in a traditional way can help patients to regain motor function and reduce disability. Recent studies and evidence suggest to perform repetitive tasks oriented training bring great benefits. However the implementation of these traditional techniques bring obstacles to the patient such as the application of tedious techniques, the use of resource-intensive, high costs generated and transportation to specialized centers, according to WHO [1]: approximately 32% or 33% of non-disabled people cannot afford medical care, compared against 51–53% of people with disabilities. This can lead to the patient doesn't adequately take recovery or in the worst case they abandon their rehabilitation therapy [11–13].

Nowadays the scientific and technologic advances could facilitate the adaptation of traditional techniques of rehabilitation therapies to the current practice and the patient's context, thereby create new ways to support therapeutic rehabilitation process, where a multidisciplinary team is defined for each a specific patient in rehabilitation. It is possible consider new devices that are primarily designed for home entertainment, devices such as home video game consoles, tablets, body movement sensors that are capable of tracking human motion in real time and with accuracy according to the needs of rehabilitation therapy. This is an area of opportunity taking into account rehabilitation environments with highly interactive components located in the graphical

user interface, as well as the incorporation of input/output devices which the patient can interact and deal with rehabilitation therapies. In this sense, software engineering is one of the areas could be used to drive the production of new forms and methods to assist rehabilitation therapies.

In order to solve some problems of patients in a such manner these patients can have a better assistance in the rehabilitation therapies a multidisciplinary production of interactive environment is proposed here; this kind of production allows to develop interactive environments systematically under an approach led by models, this involves to identify the team of experts involved in the rehabilitation process of the patient who receive occupational therapy through an adequate multidisciplinary team according to needs proposed by experts and patients, multidisciplinary team will always be different because the patient's needs never won't be the same, it must be according to the patient's rehabilitation needs. With the multidisciplinary team will be necessary to define those devices to carry out the production process of interactive environments also interactive environment includes feedback mechanisms that are useful for experts and patients. Mechanism such as adaptability and capitalization of knowledge (good practices, therapeutic processes, feedback techniques, etc.) both inserting in the interactive environments, it makes possible to offer a better assistance with the user task and the acquisition of new skills.

The following section presents more in detail the multidisciplinary production for interactive environments.

4. Multidisciplinary production for interactive environments

When a doctor considers that a patient may recover any physical ability, it's necessary to develop a therapeutic process in terms of occupational therapy. This process starts when a person suffers an accident at work or when it's doing daily activities, when this happens, the person comes to receive medical attention and health specialist determines the diagnosis that allows to know the type of disability sustained and the level functionality of the person, as well as indicating the course of treatment for recovery, which may consist of a variety of activities that are part of occupational therapy techniques, which include movements of skill, coordination, strength, etc. During therapeutic process, the patient acquires new skills that can be considered achievements, allowing the specialist to redefine again the course of treatment, then during throughout treatment several iterations are done until the patient obtain his/her total recovery [14]. Thanks to an iterative and incremental cycle during the development of interactive environments this process could be adapted to the needs arising from rehabilitation. That is, more of an interactive environment may be required to attend the entire therapeutic rehabilitation process of a patient. For this, the multidisciplinary production specified in Fig. 1 considers the participation of a multidisciplinary team and reuse existing artifacts to adapt new versions of interactive environments according the needs of therapeutic process. This production requires different customizable interactive environments under a user-centered production.

The multidisciplinary production starts with the definition of the "real world", at this phase a therapeutic process is established by the rehabilitation specialists, previously the patient should have had a medical diagnosis, (an example of it, as shown in Fig. 2). Rehabilitation experts are identified also in the real world phase in order to form the multidisciplinary team. As result of the therapeutic process it's possible to define skills based on real situations, such as skill activities, sensory, troubleshooting through movements and situations that recreate activities of daily life [15]. This analysis allows to multidisciplinary team to determine which level

Table 1
Related work given a certain support to rehabilitation process.

Work	Approach	Platform	Feedback	Open production
[4]	VR Game-based	Prime Sense Camera	Yes	No
[5]	Cloud-based prediction system	Kinect	Yes	No
[6]	Game-based, Case study	Wii	No	No
[7,8]	Interactive Rehab. System Design	Opti-Track cameras	Yes	No
[9]	Serious game	Kinect, Camera	Yes	No
[10]	Game-based	Kinect	No	No

Download English Version:

<https://daneshyari.com/en/article/6927653>

Download Persian Version:

<https://daneshyari.com/article/6927653>

[Daneshyari.com](https://daneshyari.com)