Gaming for Therapy in a Healthcare Smart Ambient

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Abstract. Games elements are transcending the usual boundaries of their medium to enhance user experience and user engagement in non-game applications. Therapeutic serious gaming allows a patient to execute specific exercises while engaging with a game, trying to achieve its goals related to therapeutic activities. A ubiquitous therapeutic game corresponds to adding these elements into a context-aware smart ambient. This paper presents a proposal towards the use of therapeutic serious games in a pervasive healthcare assistive ambient. We are implementing these games to be used in the rehabilitation of both cognitive and motor deficits, taking advantage of the infrastructure developed for assisting and monitoring elderly and disabled people. The work's research will also be used on studies to improve the system's effectiveness through personalization.

Keywords: Pervasive, personalization, therapeutic games, smart ambient.

1 Contextualization

The concept of serious gaming refers to the use of computer games to teach something to users or help them developing specific skills, without the main purpose of pure entertainment altough maintaining it [6]. Games and related technologies are increasingly transcending the usual boundaries of their medium leading towards gamification, an informal umbrella term for the use of game elements to enhance user experience and user engagement in non-game applications [3]. A main example is therapy based on serious games (theragames), with several studies and projects demonstrating the efficiency of this approach in domains such as rehabilitation after spinal cord injury and stroke [6]. Theragames allow a patient to execute specific exercises to achieve its goals and levels related with rehabilitation purposes, while playing and engaging in a game context.

Furthermore, ubitheragames combine theragames with ubiquitous computing, usually a context-aware smart ambient, mixing a digital environment with real world elements [4]. Within the last decade, new systems concepts related with pervasive healthcare [1] brought several new solutions that offer chances to create ubitheragames. Pervasive technologies permit develop interesting theragames using

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lightweight and convenient devices for tracking users' activities, RFID technology for identification of users and objects, biosensors to measure physiological vital signals, and ambient displays to deliver feedback, among other possibilities. This combination can offer valuable contributions to develop more effective games as assistive instruments for diagnosis and therapeutics monitoring in the rehabilitation field.

Motivated by the aforementioned, this paper presents a proposal towards ambient therapeutic gaming in a pervasive healthcare assistive environment (PAE) [5]. This environment serves the purpose of having a starting working system to apply the design of our theragames model proposal. It presents the following main features:

- Integrates smart objects, such as wheelchairs that have embedded sensors to measure physiological parameters and mechanical quantities (e.g., Acceleration).
- RFID technology is used to identify the patients on the wheelchairs and to locate the latter within the indoor space of application.
- An android-based tablet PC is attached to the wheelchair for information presentation and user interaction.
- The integration of ambient displays is also important to offer new opportunities for collaboration and a better resolution for combination of information, as it is being seen in healthcare environments [2].

2 The Ambient Gaming Model Design

We propose a model of gameplay criteria and principles to be followed in the design of ubitheragames based on the PAE previously presented. However, this model can be followed in the implementation of theragames in other pervasive healthcare spaces. Table 1 sketches the model presenting its principal features.

Table 1. Model's principles and gameplay criteria

Principles	Gameplay Criteria
Present Simple and Persuasive UIs	Rehabilitation Area
Consider the Patients	Game Genre
Give Performance Feedback	Game Interface Type
Apply Adaptability/Personalization	Game Modes
Register Users Interactions	Game Portability
Support Casual Play	Technologies

As a first principle, the interfaces of the games should be simple, easy to understand, user-friendly, persuasive and informative, since they are usually directed for elderly patients. Therefore, the development of these games has to take into account both patients' specificities and practitioners' needs, with a high level of acceptance by patients and therapists and demonstrating efficiency when compared to classical therapies. Another important issue is the performance feedback. The patient should receive feedback about her/his performance during the gametherapy, so s/he can have measures of the progress in achieving goals, or in their skills, over time [6]. This also increases the motivation of the patient that can receive suggestions and tips.