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SciVerse ScienceDirect

Procedia Computer Science 15 (2012) 293 – 294

Procedia Computer Science

Virtual Worlds for Serious Applications (VS-GAMES'12)

The framework of a LIfe Support Simulation Application

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Abstract

In this paper we present the framework of a LIfe Support Simulation Application (LISSA) designed to teach and learn cardiopulmonary resuscitation (CPR) skills. LISSA exploits video game technology to link in a single framework computer-based simulations of CPR emergencies with the functionalities of e-learning platforms. Emergency situations are presented as problems that the learner has to solve in a game mode. Learner actions are registered in a database. This information is used to present new problems to the learner in an adaptive learning mode. LISSA can be used as a substitute or a complement for traditional CPR classroom-based instruction or to refresh and improve CPR skill retention over time.

Keywords: Life support ; Serious Games ; Medical Simulation ; Cardiopulmonary Respiration ; Resuscitation.

1. Introduction

Cardiopulmonary resuscitation (CPR) is a first aid key survival technique used to stimulate breathing and keep blood flowing to the heart. Different strategies have been proposed to teach CPR, from traditional classroom to video self-instruction or computer-based programs [1] [2]. Also, different serious games to exercise CPR skills have been proposed. Among them, Adult CPR Simulator 2.0 [3] and Online CPR simulator [4]. Most of these games create a two dimension scenario based on text, images and video.

2. LISSA: LIfe Support Simulation Application

LISSA is a serious game designed to introduce and increase the knowledge of CPR to any kind of public. All the LISSA actions turn around a CPR scenario which reproduces in 3D an emergency situation that requires CPR procedures. This scenario is defined by the instructor and presented to the learner as an exposition case

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doi:10.1016/j.procs.2012.10.083

or as a problem. Instructors are allowed to create different CPR situations and different types of problems. The learners solve the problems applying the CPR procedures in a game mode. LISSA automatically evaluates the actions and assigns the mark. All the learner's actions are registered in a system data base allowing instructors to consult them in order to track their learning process. This information will be used to recommend new scenarios and problems based on learner errors. The main components of the LISSA framework are:

- *The instructor interface*: lets the instructor prepare CPR educational material. We differentiate between exposition material, which presents how to apply CPR procedures in a given scenario previously defined, and exercises, which represent an emergency case that has to be solved by the learner.
- *The content creation module*: is used to create the educational material (exposition cases or emergency problems) following the requirements defined by the instructor.
- *The learner interface*: shows the exposition and the problems. The learner can visualize the content as many times as he wants. To solve a problem he has to apply a set of CPR procedures which are stored as a problem solution. The proposed solution will be evaluated by the correction module and if it is not correct the learner can enter a new one. All these solutions will be recorded in the system database.
- *The correction module*: compares the correct solution defined by the instructor with the solution entered by the learner. Then, it returns feedback (a mark, solving time, etc.) defined according to the instructor requirements.
- *The system database*: registers all the actions performed by the instructors and the learners including set of graphics elements, solution of each problems and feedback returned.

To model the CPR scenario and the CPR procedures we used a UML state machine [5] by reducing the CPR flowcharts [6] to a set of states and actions, then we defined the connections between them. This same strategy can be applied to any CPR flowchart. The LISSA project follows a client server architecture. It has been implemented using Unity 3D game engine with C# as a client and apache server with MySQL database.

3. Conclusion and future work

LISSA is a serious game for teaching and learning CPR. The game turns around an emergency case which has been modeled as a finite state machine that reproduces a CPR flowchart. The first version of LISSA has been evaluated positively by a group of experts from the Infirmary faculty of our university. For the future work we plan to extend the platform to support multiple situations (indoor, outdoor, with and without medical equipment), patients of different ages and sex. Also we plan to integrate kinect [7] functionality into the game.

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