Augmented Reality for Life Support Training

Fabrício Pretto[1], Isabel H. Manssour[1], Emerson Rodrigues da Silva[3],
Maria Helena Itaqui Lopes[2], Márcio Sarroglia Pinho[1]
[1]FACIN – Faculdade de Informática - PUCRS
[2]FAMED – Faculdade de Medicina – PUCRS
[3]Hospital São Lucas - PUCRS
Av. Ipiranga, 6681 - Prédio 32 - 90619-900 - Porto Alegre/RS - Brasil
fpretto@inf.pucrs.br, isabel.manssour@pucrs.br, kiko72@terra.com.br,
mitaqui@pucrs.br, pinho@pucrs.br

Abstract

The area of Medical Qualification in Life Support training is being constantly improved. However, many problems are identified in the training process, such as the lack of realism in the exercises and the low student involvement. In order to qualify the learning process, the ARLIST project (Augmented Reality for Life Support Training) is being developed to add computational resources as sound and images, in the manikins used in the training courses. Through Augmented Reality techniques, the use of OpenGL and some computational resources (e.g. projector ad video camera), it is possible to build an application that defines the images and sounds that should appear in accordance to the patient clinical state. This ongoing work is being here described.

1. Introduction

Through the development and use of new technologies, applied computer systems contribute for the qualification and expansion of several areas.

Inside the Medicine area, the qualifying process for Life Support (LS) training is based in simulations of emergency situations, in which the students can practice in realistic patient care scenarios using manikins. Usually, these scenarios prepared by the training team, taking into account some case studies, include: reanimation operations, first aid to patients victims of accidents, sudden attacks or downfall [1]. They aim to make the students capable of helping in the first aid service.

Computer Graphics, Virtual and Augmented Reality techniques provide more interactivity and increase the realism during training process. Thus, the ARLIST Project has the main goal of qualifying the traditional training environment adding images and sound in the manikins used in LS courses.

This poster is organized as follows: Section 2 presents some requirements of the existing LS systems. The project implementation and functionalities are described in Section 3. The future work and conclusions are presented in Section 4

2. Life Support Training

LS training is developed in all over the world and is divided in the following categories: cardiac (ACLS – Advanced Cardiac Life Support), pediatric (PALS – Pediatric Advanced Life Support) and trauma (ATLS – Advanced Trauma Life Support) [3].

The main goal of these courses is to qualify the emergence medical service through specific training in each area. An important requirement during training process is to keep a manikin always present, since it is the connection with the real world.

Current manikins have several resources incorporated to allow and facilitate a qualified training, such as pulse, arrhythmia and ascultation simulator and intubation training. However, some deficiencies have been detected in the existing training structure. For example: automatic feedback to the students as consequence of their actions on the manikin, images as face expression and body injuries, and the combination of images and sounds that represent the current patient clinical state.

3. ARLIST Project

Recent methodology used in LS training, consists in the presentation of real situations for LS based in case studies. The instructor provides information about the patient's clinical state to the student and observes his/her actions during the procedure. In order to get updates about the patient's clinical state, the student needs to ask the instructor for the identification of unexpected facts, such as respiratory and cardiac arrest.

This constant communication with the instructor during training and evaluation processes may cause the student to lose attention and, moreover, hinder his/her autonomy in the emergency service[4].

Thus, the main goal of ARLIST project is to offer more information to the student during simulation, allowing him/her to make a decision in accordance with his/her observation, and reducing the need of an instructor feedback during the training process. To achieve this goal, a new environment was created: first, we built a metal structure around the training table (fig. 1a); then a camera for image capture and a video projector were suspended on the top of the structure (fig. 1b); facial expressions are then projected on a mask placed on the manikin face (fig. 1c); a waistcoat instrumented with audio connectors involves the manikin torso to allow the auscultation tests (fig. 1d).

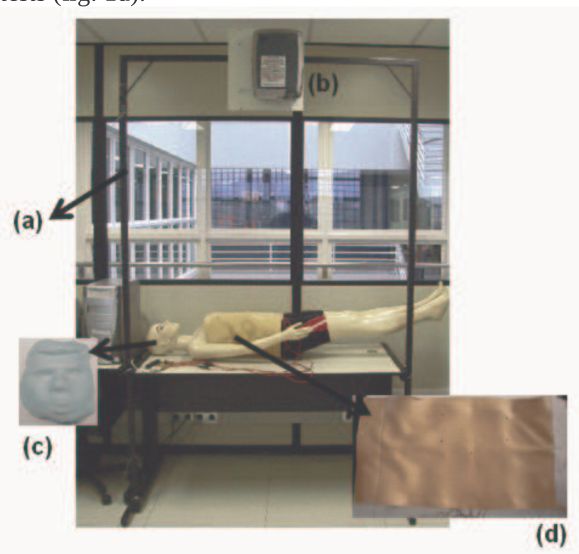

Figure 1. Developed structure.

As can be noticed, we generate two types of audio and visual signals in the manikin. For audio reproduction, female-earplug connectors were attached to the waistcoat. When the student plugs the stethoscope on a connector, the system plays the appropriate sound. To capture this event we use an analog-digital converter connected to the computer parallel port. The sound is played on speakers present in the test environment. We are also planning to adapt small speakers next to the manikin head to simulate patient talks and complaints.

The images presented on the training manikin face, display facial expressions that represent the patient clinical state and sensations. Moreover, through the Simulation Control Tool (SCT) that is being developed, the instructor will be able to specify which sound is more appropriate to be simultaneously emitted with the images.

The project is being developed using C++ language. To register the images on the manikin, allowing the student to move the manikin, we use the ARToolkit [5] library. The Expression Toolkit [6], an open source facial animation system written in C++ language, is responsible for the facial expression generation and is controlled by SCT.

4. Conclusions and Future Work

This poster describes an ongoing project in which the exhibition and image registration functionalities need to be finished and need to be tested. The Simulation Control Tool is being developed, in order to facilitate the instructor to configure new clinical situations.

Some resources as real fluid secretion will be implemented in the future, to simulate bleeding in some body regions. The last project step will be the environment and application validation. This validation will be done with some resident physicians to check the applicability of the new resources for the LS training courses. Thus, the project intends to add more realism on the current training environments.

References

[1] C. Standridge, "A tutorial on simulation in health care: Applications and issues". In: Simulation Conference Proceedings, vol: 1, 1999. 49-55p.

[2] American Heart Association. http://www.americanheart.org.

[3] American College of Surgeons. http://www.facs.org.

[4] M. Ponder, B. Herbelin, T. Molet et. al. "Interactive Scenario Immersion: Health Emergency Decision Training in JUST Project". In : VRMHR2002 Conference Proceedings, VRlab-EPFL, pp. 87- 101, Nov. 2002.

[5] ARToolKit. http://www. www.hitl.washington.edu/artoolkit.

[6] The Expression Toolkit.http://expression.sourceforge.net