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Thesis Project Form

Title (tentative): Design and Development of a portable newborn resuscitation training device for low-income medical settings

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Description

Motivation and application domain

A nonnegligible portion of newborn deaths is due to the lack of expertise in performing neonatal resuscitation maneuvers by the medical personnel involved in delivery room care. In fact, only a few specialists in the delivery room master Newborn Life Support (NLS), typically well-trained neonatologists and anesthesiologists. Nevertheless, sometimes these specialists may not be present in the delivery room for several reasons including: multiple deliveries occurring at the same time; lack of resources, especially in low-income countries or small birth centers; deliveries which suddenly turn into medical emergencies; deliveries happening outside of the hospital settings. Within this framework, it is required that all the healthcare providers involved in the delivery room care are trained to face neonatal resuscitation.

A possible way to increase the number of healthcare providers trained in NLS is through simulation. However, high-fidelity simulators are expensive tools requiring technicians' supervision and dedicated spaces, thus making them usable only in simulation centers. In other words, low resource settings, small hospitals, universities usually do not have access to sensorized simulators and thus cannot objectively and systematically assess and train healthcare providers, leading to education inequalities, which ultimately affect the survival rate in the delivery room.

General objectives and main activities

The goal of this project is to develop a portable and affordable instrument for NLS training and evaluation, specifically designed to be used in low-income settings. The system includes low-cost electronic components that can be easily installed in any low-fidelity manikin or custom-made solutions. With this solution, we aim at maximizing the possibility of using existing tools in hospitals and low-resources simulation and education facilities, thus providing a high-quality training and evaluation of NLS.

The project can be divided in different parts:

- Design of the system. The student will identify the most appropriate sensors, electronic components, and power supply considering their size, their cost, the final positioning, and the life support tasks to be monitored. Subsequently, the hardware and the software architecture will be designed considering possible application sites, and the need to easily calibrate the sensors and the requirement of providing feedback on the user performance in a simple, immediate, and easy way.

- Hardware and software implementation. This phase includes programming the microcontroller and testing the sensors;

selecting the visualization device and creating the graphic user interface that provides performance feedback,

- Tests. The system will be tested with both experts and subjects without medical knowledge to assess whether it meets the requirements of usability, user experience and portability.

Training Objectives (technical/analytical tools, experimental methodologies)

The student will learn to:

Understand how to select and use sensors and microcontrollers

Define a hardware/software architecture, including sensors, and communication.

Assembly/manufacture the hardware components

Design and develop a system for medical training and evaluation

Understand how to convert an idea into a prototype

Work with a multidisciplinary team made of clinicians and engineers

Place(s) where the thesis work will be carried out: Joint lab for Emerging Technologies in Simulation JETS @SimAv, Via Pastore 3, Genova; Servizio di Patologia Neonatale e TIN, IRCCS Istituto Giannina Gaslini, Via Gaslini 5, Genova

Additional information

Maximum number of students: 1