Virtual ACS 2021 Surgeons and Engineers: A Dialogue on Surgical Simulation Meeting

Research In-Progress

Augmented Reality Based Simulation Training for Extra Corporeal Membrane Oxygenation (ECMO)

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Introduction: Extracorporeal Membrane Oxygenation (ECMO) is a complex procedure that provides life support to patients with respiratory and cardiac failure. Managing patients in ECMO is challenging than conventional care and requires an understanding of the cardiopulmonary physiology and working of ECMO machine. Simulation based training can be an effective method to improve the knowledge and skills required to perform the procedure among novice trainees. We present an augmented reality application to train healthcare professionals obtain the skills to interact with the ECMO machine and succeed in performing the procedure.

Methods: An augmented reality based ECMO trainer is developed in Unity™ for the Microsoft HoloLens. The user interacts within the augmented reality environment using hand gestures. The objectives of the application are : (1) familiarize the users on identifying essential components of an ECMO equipment and practice establishing appropriate connections (2) simulate various scenarios to train on observing the alterations in the ECMO parameters and physiological vitals, thus making decisions to restore back the normal condition. (3) pre- and post-assessment sections to determine the knowledge level of the trainees.

Preliminary Results: In the preliminary phase, various scenarios associated with the ECMO procedure have been identified. The developed module consists of (1) a free exploratory mode where the learner can inspect the different components of ECMO machine followed by an interactive assessment. (2) the user then proceeds to the next module, which guides them through establishing connections in the ECMO circuit.

Next Steps: Future work will involve simulating various clinical scenarios thus enabling the user to understand the interaction with the equipment to resolve problems. We intend to perform a study with medical trainees comparing their learning and performance with and without augmented reality-based learning experience to study the efficacy of training.

Welcome to ECMO training experience.

Part 1 - Training

Part 2 - Assessment

Part 3 - Connections

Scenarios

Display monitor ⓘ
Continuously monitors vitals like ECG, heart rate, pre and post membrane oxygen.

Blood gas monitor ⓘ
Continuous inline blood gas monitoring. Measures blood parameters like SvO2, SaO2 and Hct.

Blender/Gas sweep ⓘ
A device which controls the level of oxygen being supplied to the blood.

Find the Oxygenator
Incorrect Selection
Remaining Attempts: 2

Welcome to part 3 - Training of components connection.

You will be first prompted to establish the major connections of an ECMO circuit. Drag the ends of the wires/cannula to move it to desired positions.

Next