

In Silico Testing of Augmented Reality Interfaces: An Intensive Care Unit Simulation

Project Management and Software Development
for Medical Applications



Please send the completed proposal to tianyu.song@tum.de, shervin.dehghani@tum.de and felix.tristram@tum.de. Please note that this proposal will be evaluated by the BMC coordinators and will be assigned to a student only in case of acceptance.



General Info

Contact Person: Prof. Daniel Roth (TUM, Clinic)

Contact Email: daniel.roth@tum.de

Project Abstract

The project aims at improving a virtual reality (VR) intensive care unit simulation and evaluating augmented reality interfaces that are simulated in this environment for in silico testings. These interfaces are designed to display selective information to the users and in turn reduce the stress level of personnel. The prototype is developed in Unity (C#) and students are expected to improve the prototype guided by discussions, and perform a user study.

Background and Motivation

Medical staff working in ICUs are constantly exposed to a variety of alarms from different monitoring devices. This stimulus-saturated working environment contributes to the stress and workload experienced by nurse [1]. While testing of novel interfaces and systems in a real ICU is challenging, virtual reality (VR) represents a powerful tool and methodology to simulate an ICU environment and test optimization scenarios. We have developed a VR simulation of an ICU that is capable of providing an immersive and realistic display of a reproduced stress simulation in the form of visual and audible alarms, close to a real-world scenario. An initial user study investigated how the selective presentation of alarms affects ICU nurses' workload and stress [2].

AR has shown to be a valuable tool for alarm distribution and patient monitoring. The current project investigates how an Augmented Reality (AR) head-mounted display for alarm management can be integrated into the simulation and thus tested in silico. The primary goal of this project is to improve the current AR System and the ICU simulation itself.

Student's Tasks Description



The project has the objective of enhancing the current implementation in several technical aspects.

- Functional improvements
- Feedback and metaphor design improvements
- Locomotion improvement

Furthermore, the project intends to empirically evaluate these enhancements by conducting a user study involving medical expert participants.

Technical Prerequisites

Students should have previous knowledge in developing 3D applications using the Unity 3D engine or in programming C#. They should be motivated to prioritize usability and user experience and willing to collaborate with both novices and experts to enhance and test the system.

References

[1] Sandhu, S., Lin, A. L., Brajer, N., Sperling, J., Ratliff, W., Bedoya, A. D., ... & Sendak, M. P. (2020). Integrating a machine learning system into clinical workflows: qualitative study. *Journal of Medical Internet Research*, 22(11), e22421.

[2] Theelke, L., Metzler, F., Kreimeier, J., Hauer, C., Binder, J., Roth, D. (2023). Investigating the Effects of Selective Information Presentation in Intensive Care Units Using Virtual Reality. In *2023 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)*. IEEE.

[3]

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