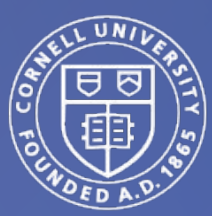


# Enhancing Emergency Room Response through Hands-Free Augmented Reality Assistance

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## Introduction

The Emergency Room (ER) is a high-stress environment where healthcare workers (HCWs) must manage multiple tasks simultaneously with precision [1]. Augmented reality head-mounted displays can assist with such tasks [2].

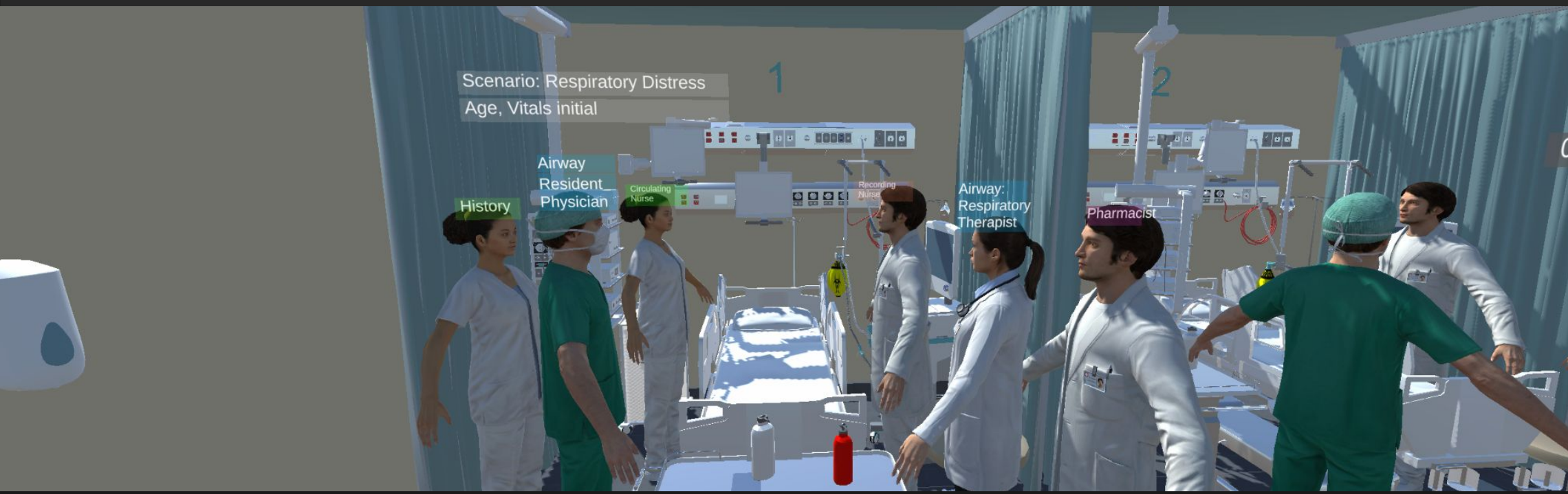
Co-design research has been conducted for clinical teams to improve teamwork [3]. This study expands upon prior work through using these participatory methods to design AR-HMD interfaces for HCWs.



Our goal is to understand AR-HMD's role in enhancing decision-making and teamwork in emergency medical care. Our primary interest is interface design and hands free interaction enabling better patient care.

## Methods

We conducted **semi-structured interviews** with HCWs. The interviewer explained the study's purpose and what augmented reality can accomplish.



Conducted co-design studies of AR-HMD applications in Unity with 12 HCW participants. The **low-fidelity prototypes** provided context to spatially understand the interfaces and draw insights on the design preferences of HCWs.

## Findings

Below are selected results from the interviews:

### Role and task tracking



Roles

- Display name, title, and role in a visual above the HCWs head.
- Keep track of tasks outside of the field of view of the AR-HMD wearer.

### Automatic dosage calculation



Dosage

- Auto-populate medication dose and concentration by verbalizing medication name.
- Calculate doses; age and weight (for pediatrics).

### Interactive time management



Timers

- Timers for tracking ie. CPR, EPI, Shock
- The timer's color should change after a set time to indicate action is needed.

### Medical records/ Diagnosis



Other

- Connect with EMR for patient information, history, and medication list.
- Assist with potential pathways and considerations for diagnosis.

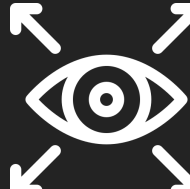
## AR-HMD Design Concepts



Customization



Minimize Visual Distraction



Information Relevance



Transparency



Reliability



Minimize Interaction Distraction



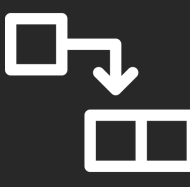
Visibility



Target Wearer



Automation



Visual Placement



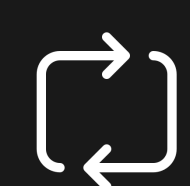
Record Keeping



Facility Resource Variation



Situational Awareness Enhancement



Closed-Loop Verification



Privacy Protections



Patient Education



## Discussion

- These guidelines will hopefully lead to functional and intuitive AR-HMD applications that minimize cognitive load and maximize user engagement which is essential in high-pressure environments such as acute care setting like the ED [4].
- ER procedures such as resuscitations are complex. AR-HMD's can help, but it risks missing crucial information or causing distractions. Our study found that **quick access to key information and proper feedback** could prove essential, with design guidelines varying by situation and HCW specialization.

## Future Work

- We plan to explore various other AR-HMD applications in a similar way and to **test the prototypes** in medical simulations such as the Base Camp event at Weill Cornell Medicine.
- While currently focused on in-hospital care, we are excited to extend our work to pre-hospital care. We envision using **AR and assistive technology** for **emergency medical services**, benefiting both field and ambulance settings.

## References

1. Gualano, Maria Rosaria et al. "The Burden of Burnout among Healthcare Professionals of Intensive Care Units and Emergency Departments during the COVID-19 Pandemic: A Systematic Review." *International journal of environmental research and public health* vol. 18,15 8172. 2 Aug. 2021. doi:10.3390/ijerph18158172
2. Eckert M, Volmerg JS, Friedrich CM. Augmented Reality in Medicine: Systematic and Bibliographic Review. *JMIR Mhealth Uhealth*. 2019 Apr 26;7(4):e10967. doi: 10.2196/10967. PMID: 31025950; PMCID: PMC6658230.
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