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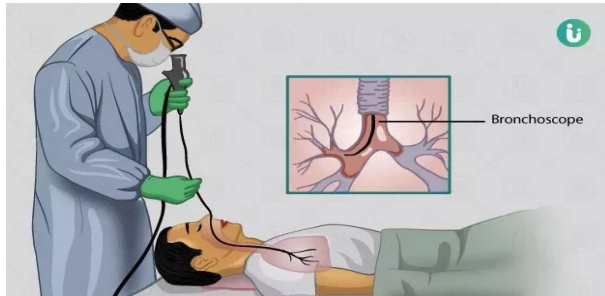


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Research Project

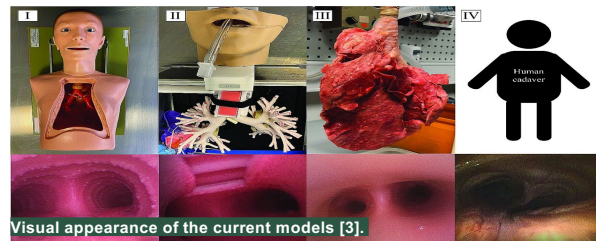
## Motivation



Bronchoscopy is a surgical technique for viewing the interior of the airways. [6]

- **Bronchoscopy** is a complex procedure that requires precise hand-eye coordination, spatial awareness, and the ability to navigate intricate airway anatomy skills that are especially critical in pediatric cases.
- Traditional simulators often lack anatomical realism, adaptive feedback, and dynamic motion.
- Integrating Virtual Reality (VR) and Artificial Intelligence (AI) offers a promising approach to improve the safety, effectiveness, and confidence of bronchoscopy training [1,2].

## Research Problem



Visual appearance of the current models [3].

Current bronchoscopy simulators often use static models, provide limited feedback, and rarely address the complexities of pediatric anatomy. These limitations can hinder the development of essential skills and reduce training effectiveness. There is a clear need for immersive, intelligent simulation tools that offer anatomically accurate and clinically relevant experiences to better prepare trainees for real-world bronchoscopy [3,4].

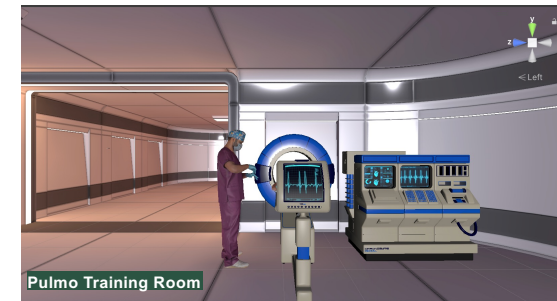
## Research Objectives

This research aims to develop a patient-specific VR-based bronchoscopy simulator that integrates real-time AI feedback to support immersive, skills-based training. High-fidelity 3D airway models are reconstructed from CT data to simulate anatomically accurate clinical scenarios within a VR-based environment. The system incorporates AI-driven guidance to assist with procedural navigation and correct technique. Evaluation will be conducted through user studies involving pre and post training assessments to measure training effectiveness, anatomical fidelity, and user experience. This project adopts a User-Centred Design approach to develop and integrate extended reality (XR) technologies into bronchoscopy workflows.

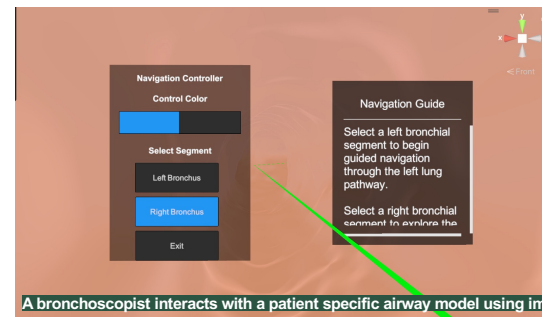
## Current Progress



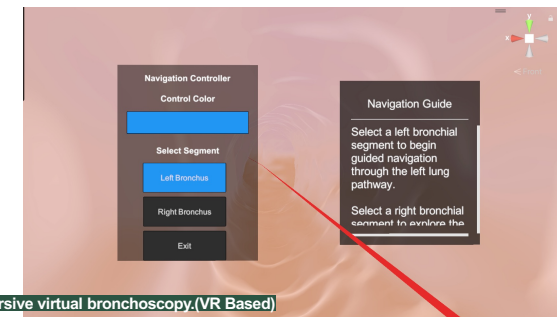
Pulmo Training Room



Pulmo Training Room



A bronchoscopist interacts with a patient specific airway model using immersive virtual bronchoscopy (VR Based)



An initial prototype of the VR bronchoscopy simulator has been developed, incorporating CT-derived 3D airway models for adult anatomies. The core visual interface is functional, allowing immersive navigation through segmented bronchial structures. A real-time feedback system is currently in progress, with AI logic integrated for basic navigation support. The next phase will involve pilot testing with clinicians to gather feedback and refine the system for clinical relevance and training effectiveness.

## References

1. Cold KM, Konge L. Simulation-Based Training in Flexible Bronchoscopy. *Chest*. 2023.
2. Cicco M, et al. Structural and Functional Development in Airways Throughout Childhood. *Pediatr Pulmonol*. 2021.
3. Ho BHK, et al. Multi-material 3D Printed Models for Bronchoscopy Simulation. *BMC Med Educ*. 2019.
4. Andersen AG, et al. Immersive VR for Bronchoscopy Training. *Respiration*. 2023.