UBC Emerging Media Lab

AR-A-SOP

Spring 2025

Purpose

Augmented Reality Assisted Standard Operation Procedures (AR-A-SOP) aims to enhance student learning, safety, and confidence when operating machinery at UBC's Centre for Advanced Wood Processing (CAWP) using Augmented Reality (AR). By leveraging the Apple Vision Pro headset, the project creates an interactive AR training program to guide students through the process of replacing the sawblade on the Martin T75 sliding table saw. This tool provides step-by-step, visually guided instructions that complement in-person demonstrations and allow for self-paced, hands-on practice, improving learning retention and providing a reusable training resource.

Project Details

Intro: The user is taught basic controls for the Apple Vision Pro including eye movement, pinching/dragging, and clapping.

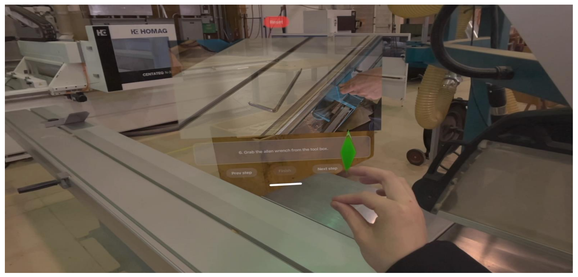
Calibrate: The user is instructed to look at the logo on the machine to calibrate the program.

Repair: The user is guided step-by-step through the process of replacing the sawblade on the Martin T75 sliding table saw. Digital overlays and visual cues highlight each task, from safely disengaging the machine and removing the existing blade to installing the new one and reassembling the components. Throughout the process, the system provides text and video instructions.

Process

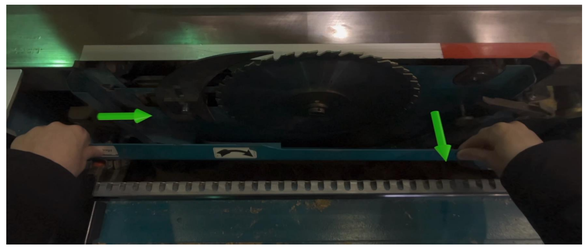
Development

This augmented-reality assisted tutorial was developed for the Apple Vision Pro using Xcode 16.2 beta, targeting visionOS 2.0. The application leverages SwiftUI for declarative interface design, RealityKIt for rendering 3D content in an immersive environment, and ARKit's image tracking capabilities to detect a "Martin" logo on the physical machine, establishing a spatial anchor that defines the coordinate system used to introduce "instructional entities" such as visual overlays, 3D markers, contextual indicators. We similarly use ARKit for hand tracking, enabling the system to detect user hand gestures and collisions with virtual objects to ensure a smooth tutorial experience.



Design

The project's interface is designed using SwiftUI, ensuring a seamless and native experience on the Apple Vision. All user interface components are built with standard visionOS interface conventions. The immersive UI features interactive buttons, inline and embedded video playback, textual explanations, and virtual instructional entities. Each step is presented within a spatially anchored window, which users are free to move around and manipulate based on their active needs.



User Research

A round of user tests was conducted at the CAWP at UBC. The goal of these user tests was to determine usability issues associated with the Apple Vision Pro and its unique learning curve. Overwhelmingly participants reported that the application would be applicable in a classroom setting. Accessibility concerns around eyesight is a valid issue, as many participants struggled to see clearly, even post-calibration. Every single participant* in our user test completed the tutorial; the majority did so in less than the allotted time frame. Participant feedback indicated that we should place greater emphasis on standard Apple Vision navigation and manipulation commands.

* one participant had to redo the user test, as they needed to put contact lenses in; they also successfully finished the tutorial.

Key Features

- Uses the Vision Pro's spatial capabilities to identify the physical sliding table saw and align digital content precisely to real-world components.
- Provides a full, guided experience for replacing a saw blade, including detailed visual instructions overlaid directly on the machine
    - We support several modalities of instruction, from text and video, to augmented reality-based indicators
- Guards are implemented so that the user does not skip over any instructions during the repair

Next Steps

- The application was designed to be extensible; it is almost effortless to support other machines in the future
- Tutorial text should change based on a user's selection of language
- Voice commands could aid in eliminating the overhead of manually changing between steps in the tutorial, particularly when users are directly interacting with the machine

Reference / Bibliography

- John Haney, Hand Gestures, https://github.com/johnhaney/HandGesture
- Apple visionOS Documentation, https://developer.apple.com/documentation/visionos/

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