CENTER ON Pervasive Personalized Intelligence

Together We Go Farther

The WizARd and Apprentice: Augmented Reality Expert Capture for Training Novices

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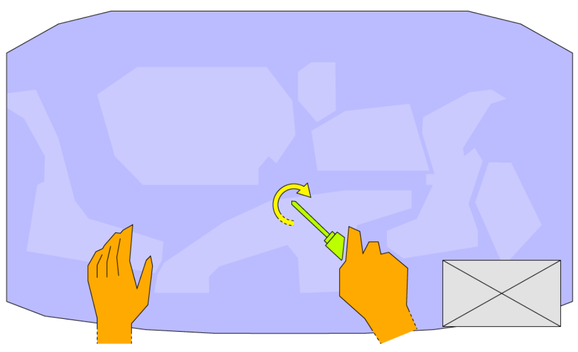
Problem and Industrial Relevance

In the industrial landscape, skilled workers play a crucial role in maintaining complex machinery. Traditionally, an apprentice would look over the expert's shoulder to learn hands-on. Augmented reality (AR) is an efficient form of delivering spatial information and has great potential for training workers. **The WizARd and Apprentice** looks at recording experts' movements for training novices in an unsynchronized way. Unlike synchronous methods, our approach allows remote workers—deployed to distant, internet-deprived locations—to access critical guidance without delay.

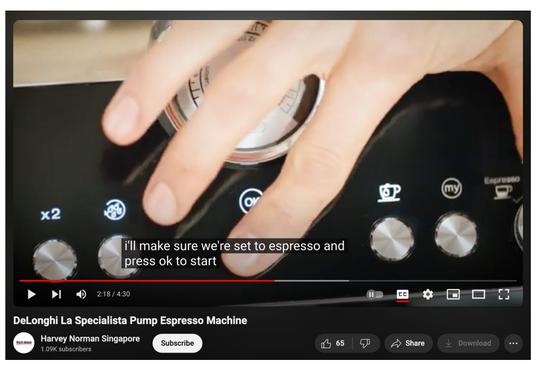
Our Approach

We used AR head-mounted display to capture experts' movements and replay them for novices. Specifically, we explored automatically generating spatial annotations with verbal instructions while recording. The spatial annotation can be used for guidance and step-checks when replaying.

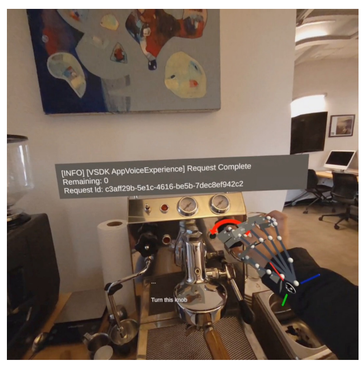


➢ Annotation with Verbal Cues

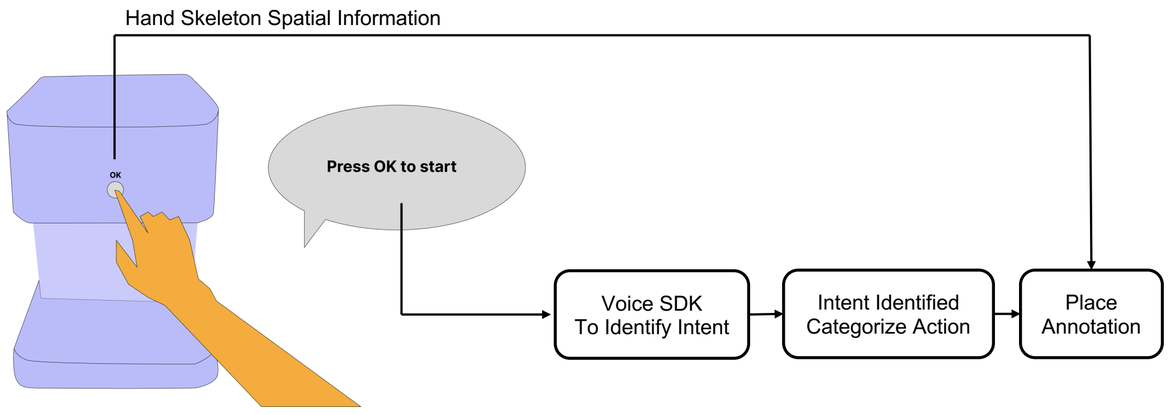
We examined instructional videos on Youtube and found that when giving instructions, people tend to talk about the action while doing it.



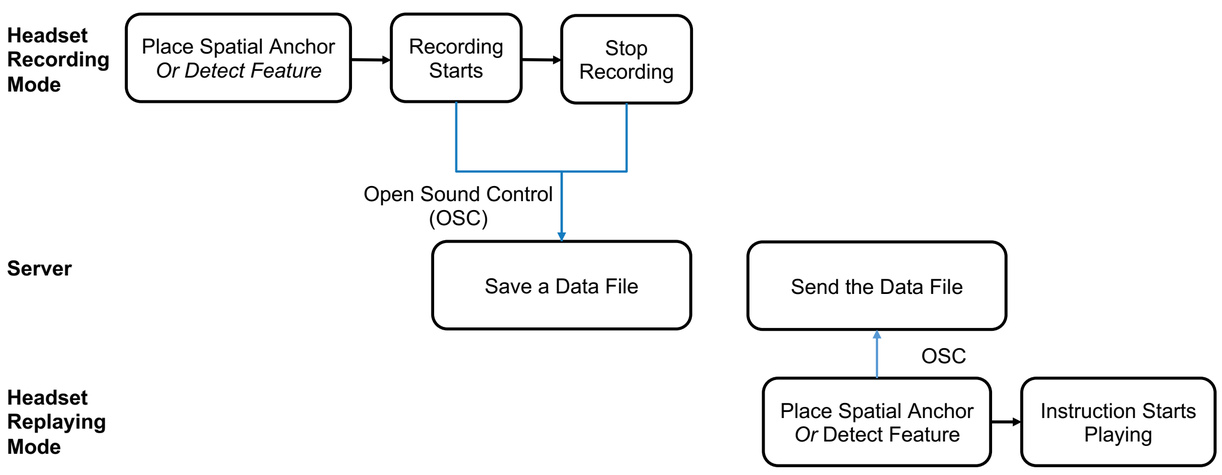
Youtube Video on Using Espresso Machine with Captions On



Our Demo



➢ Pipeline



➢ Data Structure

Data	Data Type	Sample
Time Stamp	`String`	2/22/2024 6:49:26 PM
Right-Hand Skeleton	`Matrix4x4* 24`	
Left-Hand Skeleton	`Matrix4x4* 24`	
Head Position	`Matrix4x4`	
Marker	`String, Matrix4x4`	"SelectMarker"

Future Works

In the future, the captured spatial annotations will be key event allocators to help novices while replaying the recordings. The space information will be used for step checking. When novices accomplish the current step, the system will display the next segment of the recording.
The information can also be used for creating a spatial guidebook and providing segmentation on the recording timeline.

Spatial Guidebook

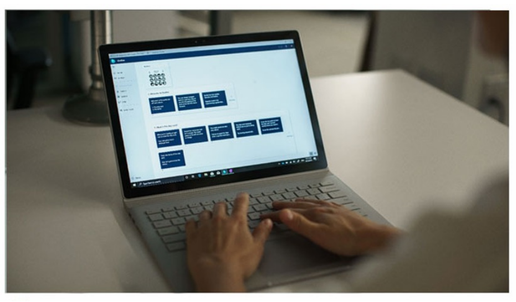
Tutorial Segmentation

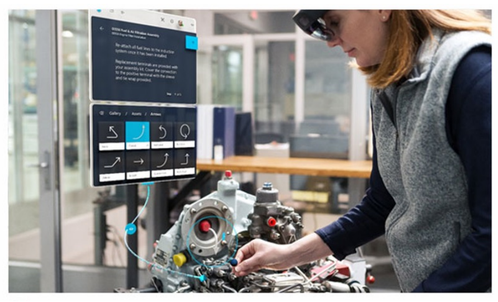
Evaluation

We will conduct a user study to compare the system usability and efficiency between The WizARd and Apprentice with Microsoft Dynamic 365 Guides. The study will consist of two parts: authoring mode and learning mode.

➢ Authoring Mode

In authoring mode, we will compare the completion time and adopt a Linker-type questionnaire for system usability.





Microsoft Dynamics 365 Guide Authoring Mode

➢ Learning Mode

In learning mode, the times required to press pause/next step will be counted. A Linker-type questionnaire will be used to evaluate system usability.

Microsoft Dynamics 365 Guide Learning Mode

Summary

1. We introduced **The WizARd and Apprentice**, an intelligent assistant to record and replay physical tasks using AR headsets.
2. We examined instructional videos and found synchronicity between verbal instructions and actions.
3. We will conduct a user study to compare the system usability and efficiency with the baseline, Windows Dynamics 365 Guides.
4. The recorded information can be applied to creating spatial guidebooks in the future.