AccessXR: A Wearable XR System for Real-Time Accessibility Infrastructure Detection and Mapping

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Introduction

- Existing public infrastructure may not always meet accessibility needs for people with disabilities.
- These barriers may persist because they often receive insufficient insitutional attention.
- AccessXR is an offline computer vision inference pipeline for the VITURE Luma Pro XR glasses, capable of detecting accessibility related objects in real-time [3].

System Overview

- Camera input comes directly through the VITURE glasses camera at 30 FPS.
- Employs a custom YOLO26m model for quick object-detection [4].
- Local Qwen2.5 LLM to provide concise and natural scene descriptions that can be played back to the user audibly.
- Voice commands supported for easy and accessible interaction.
- All complete with a multithreaded application and display created with PyQt and the Ultralytics YOLO app for ease of use [2].
- Runs on macOS, iPadOS, and Jetson Orin Nano.

Device-By-Device Testing



Avg. FPS: 31.5



Avg. FPS: 30.0



Avg. FPS: 19.6



Figure 1. AI generated concept art of the glasses and the application.



Figure 2. Example of a detection from the YOLO model.



Figure 3. Example of a view through the glasses on macOS.

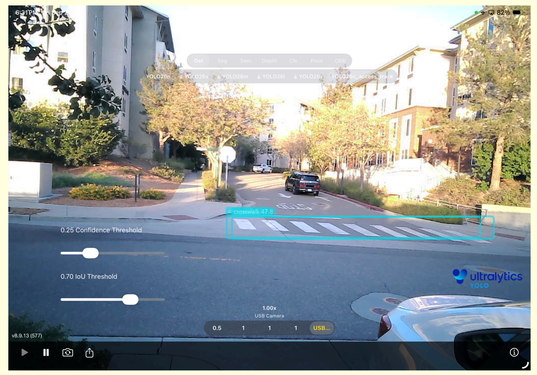


Figure 4. Example of a view through the glasses on iPadOS.

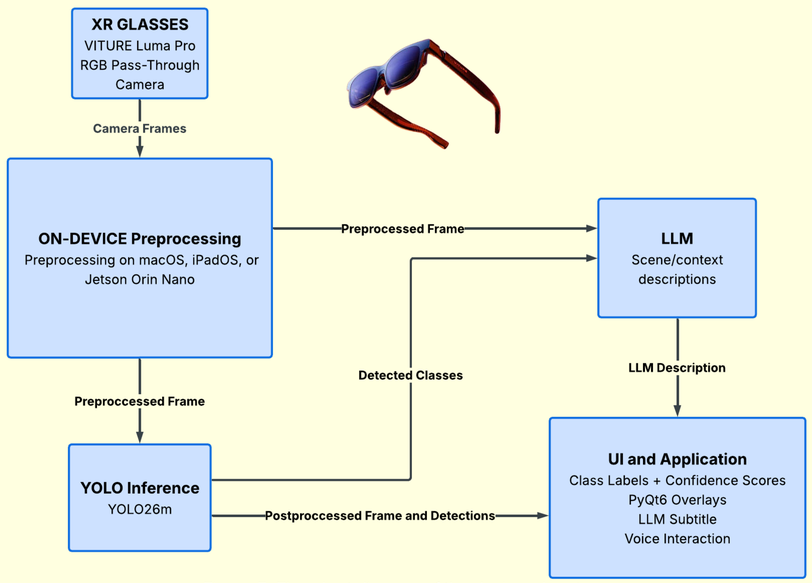


Figure 5. Flowchart diagram of the designed system.

Limitations and Challenges

- LLM and model performance under poor lighting, motion blur, or large distances.
- Limited FOV of the VITURE glasses XR display also constrains the amount of information that can be presented at once.
- Supporting mobile deployment, since iOS intrinsically blocks access to external cameras and not all Android models have display output.

Impact

- Supporting more informed and confident navigation.
- Enabling scalable AI-assisted infrastructure data collection.

Future Work

- Expanding the dataset to include additional classes and geographical areas.
- Improving voice interaction, more selectively presenting XR overlays and audio feedback, and improving handling of uncertain detections.

References

[1] M. Saha et al., “Project Sidewalk: A web-based crowd- sourcing tool for collecting sidewalk accessibility data at scale,” Proc. CHI Conf. Human Factors in Computing Systems, 2019.

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