BokodeVision: Gaze-Activated Bokode Display for Smart Glasses

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Motivation

Smart glass interactions today suffer from limitations:

Voice commands:
social awkwardness [1], sensitive to noise
Touch controls:
slower task completion, fatigue [2]
Hand gestures:
low accuracy, fatigue [3].

What if we could use **gaze** instead?
unobtrusive, effortless, accurate

New Technique

I developed a near-eye display for simple icons and gaze-based interactions. 3D printed holder for optics, inspired by Bokodes [4], for *lens, optical transparency with diverse icons, diffuser, LED*

Integrate off-the-shelf Pupil Labs eye tracker to simplify design complexity, focusing on building the display. Eye tracker connects to laptop to transmit gaze data after initial calibration sequence.

Arduino Nano turns on display when user is looking towards it. This can be used to trigger actions on other devices or used in conjunction with other interaction modes

Related Work

1. Gaze detection for spatial localization in vision-language model queries [5]
2. Always-on near-eye displays [6] can lead to higher power-consumption and eye strain

References

[1] Moorthy & Vu, Privacy Concerns for Voice Assistants, IJHCI, 2015
[2] Hsieh et al., Hand Gestures for Smart Glasses, CHI '16, 2016
[3] Mohamed et al., Hand Gesture Recognition, IEEE Access, 2021
[4] Mohan et al., Bokode, SIGGRAPH '09, 2009
[5] Konrad et al., GazeGPT, ArXiv, 2024
[6] Olwal & Kress, 1D Eyewear, ISWC '18, 2018

Experimental Results

The pattern on the transparency is placed near f = 3mm from the lens so that it appears magnified at a far distance to the user for comfortable viewing. We can verify this by manually focusing a camera.

3D printed holder, gaze-tracker, and arduino along with all electronics are attached to a frame for prototyping. The goal is to eventually have an untethered system with an onboard power supply.

More quantitative research can be done through user studies comparing task completion time and user preferences in comparison to other modes of interaction