SD 6

Gaming Control Using Gaze and Gestures

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Goals

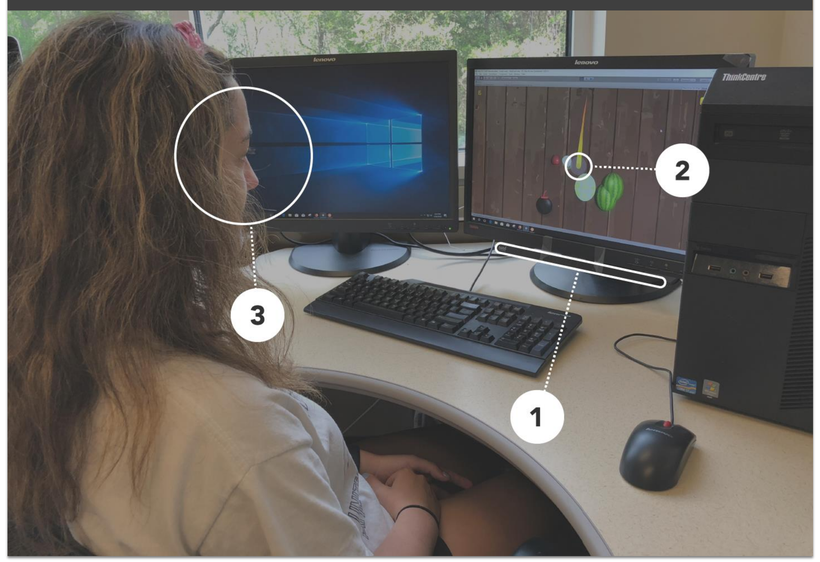
- Make the selected software more accessible, widening the potential audience and increasing user interaction
- Give users heightened control over their experience by increasing the number of input channels in an efficient, versatile manner
- Analyze performance with gaze/gesture, mouse, and hybrid control schemes to understand how a user's actions vary consequently

Gaze and Gestures

We selected the Tobii Eye Tracker 4C as the hardware to implement both the eye-tracking and head position for the accompanying control schemes. The tracker uses micro projectors and sensors to keep a constant stream of high frame rate images to detect the user's eyes and head position.

For our specific implementation, we have taken this hardware and implemented it into an open source game, adding additional smoothing and data collection in order to improve the users experience and the fluidity of the already impressive technology.

Hardware



1. The start of the process, the eye tracker, begins by using sensors to detect, calibrate, and begin tracking a user's movements
2. The user then focuses and shifts their gaze on the screen, while the tracker adjusts accordingly
3. The user's gaze itself can interact with any point on the screen through a series of high frame rate images resolved by the eye tracker.

Methods

The eye movements and head positions are collected by the Tobii 4C, and are then accessed and interpreted from within the game engine via the Tobii developer API.[1] The eye movements in particular are further refined via a system of carious smoothing algorithms implemented within the game. During gameplay all data is aggregated and, upon completion, stored in a relational database for replay playback and further analysis.

Potential Uses

Creating an extra level of immersion opens the door to entirely different implementations of products which can be further refined as the number of possible Novel Interfaces increases over time. Some fields that could be impacted are:

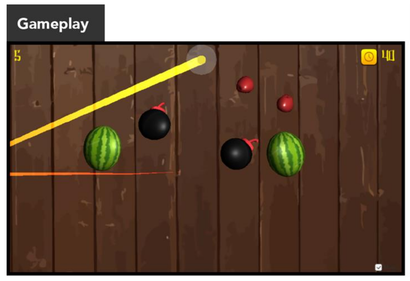
- Entertainment, as demonstrated here
- Education improving student interaction and participation[2]
- Military to create a more realistic simulation experience for training purposes[3]
- Marketing to analyze potential vision patterns in various consumer demographics[4]

Hybrid Control

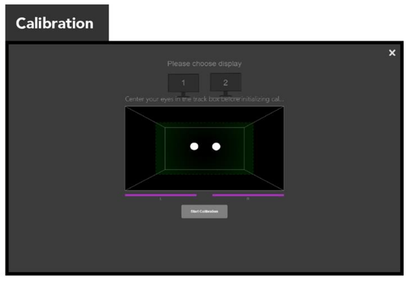
In addition to eye tracking alone, one of the major focuses of this project is utilizing the Tobii 4C gesture measurements both individually as well as in tandem with traditional control schemes. To this end, we also track the head position of the user during gameplay as a means to allow them to adjust the overall speed of play. In both the Tobii-only and hybrid versions of the game, the user will be able to control the overall speed of the game by rotating their head vertically. We believe this adds an extra element of immersion, and when properly utilized provides a performance increase and higher-quality experience for players.

Screenshots

Gameplay



Calibration



References

1. "Documentation for the Tobii SDKs and Tools." Tobii Developer Zone, 7 June 2017, developer.tobii.com/documentation/.

2. E. Yecan and K. Cagiltay, "Cognitive Styles and Students' Interaction with an Instructional Web-site: Tracing Users through Eye-gaze," presented at the Advanced Learning Technologies, 2006. Sixth International Conference on, 2006

3. J. L. Diaz, C. Bil, and A. Dyer, "Visual Scan Patterns of Expert and Cadet Pilots in VFR Landing," 2017.

4. T. Beelders and L. Bergh, "Age as differentiator in online advertising gaze patterns," 2014, pp. 260–269.