Technical Disclosure Commons

Defensive Publications Series

June 11, 2019

Optimizing for interpupillary distance in augmented reality eyewear

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Optimizing for interpupillary distance in augmented reality eyewear

ABSTRACT

To create an accurate field of view (FoV), augmented reality (AR) eyewear is optimally matched to the user's interpupillary distance (IPD). However, the IPD varies from person to person. This disclosure describes AR eyewear that (with user permission) automatically measures the IPD of a user and adjusts its depth and width to match the user's IPD. The user facing interface is personalized based on the physical FoV of the user's eyes.

KEYWORDS

- Interpupillary distance
- Field of view
- Augmented reality
- Eyewear
- AR glasses
- Virtual reality
- Variable nose support
- Nose-bridge
- Nose-pad
- Linear actuator motor

BACKGROUND

The distance between the pupils of human eyes is known as the interpupillary distance (IPD). To create an accurate field of view (FoV), e.g., vertical and horizontal angular spreads of the optical field that includes relevant real and virtual objects, augmented reality (AR) eyewear is optimally matched to the user's IPD. However, the IPD varies from person to person.

DESCRIPTION

This disclosure describes AR eyewear that, with user permission, automatically measures the IPD of a user and automatically adjusts its depth (distance of the glasses from the eyes) and width to match the user's IPD.

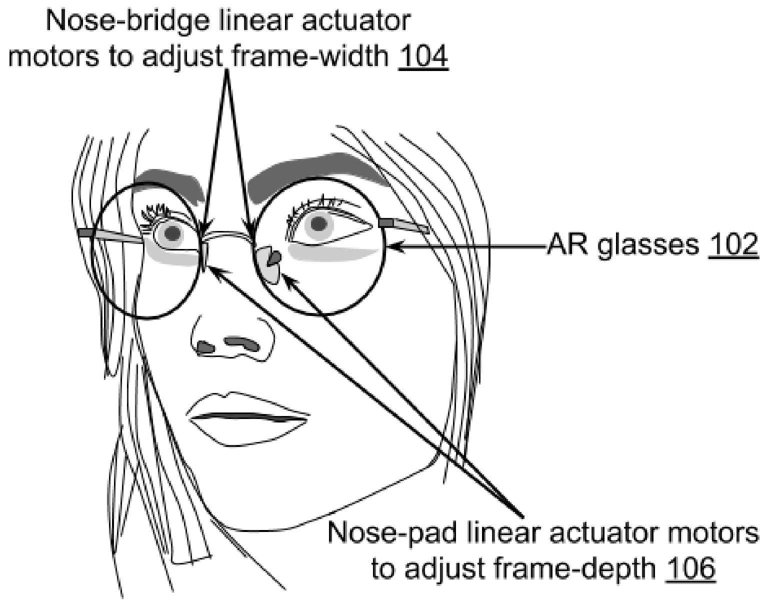

Fig. 1: Adjusting eyewear to match a user's IPD

Fig. 1 illustrates the adjustment of eyewear to match a user's IPD. Per techniques of this disclosure, eye-tracking sensors situated on the AR eyewear (102) measure the user's IPD with the user's permission. Proximity sensors, e.g., situated on the AR eyewear, measure the distance of the eyewear from the user's face, with the user's permission. Linear actuator motors positioned on the nose-bridge (104) automatically adjust the width of the eyewear frame to match the user's IPD. Linear actuator motors situated on the nose-pad (106) adjust the depth of the eyewear frame, e.g., distance of the glasses from the eyes, to better match the user's IPD. The depth and width adjustments are carried out based on feedback from the proximity sensors and the eye-tracking sensors.

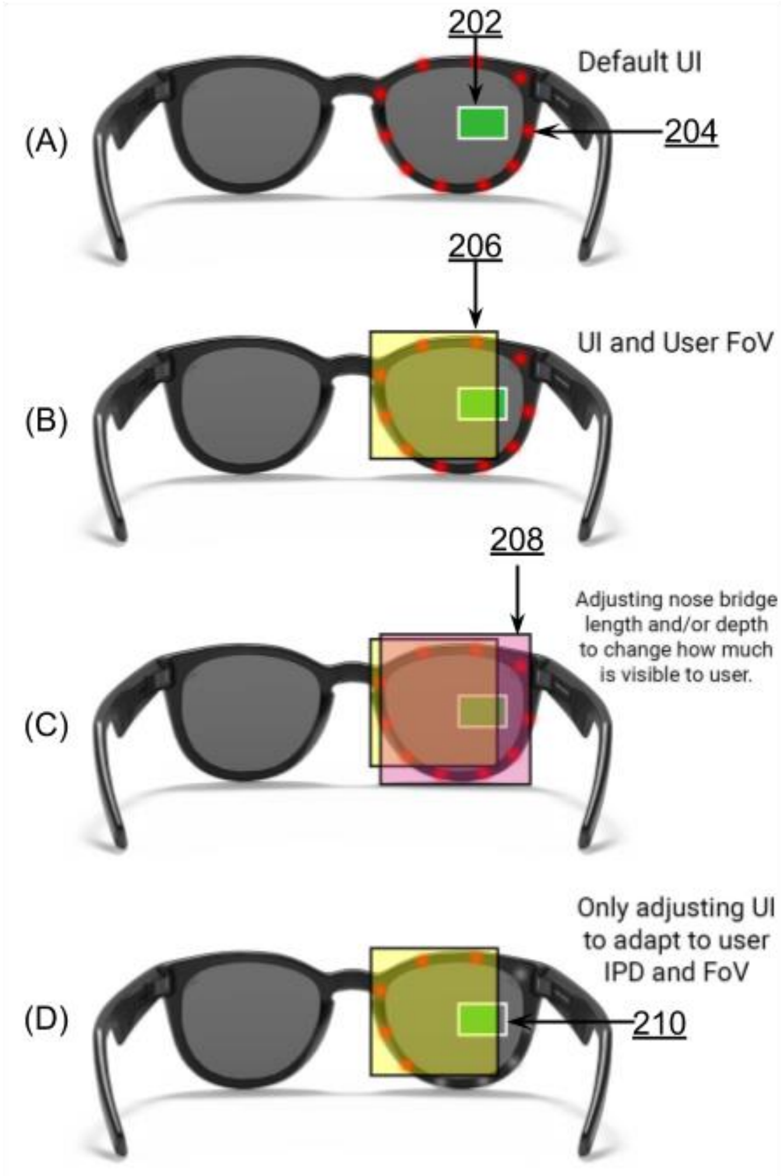

Fig. 2: The relative positioning of virtual objects within the user's FoV under various eyewear settings. (A) Position of virtual objects; (B) The user's FoV when the eyewear dimensions are not matched to the user's IPD; (C) The FoV after optimizing the eyewear dimensions to the user's IPD; (D) Adjusting the position of virtual objects to match the user's FoV

Fig. 2 illustrates the relative positioning of virtual objects within the user's FoV under various eyewear dimensions. Fig. 2A illustrates the default (unoptimized) position of virtual objects, represented by the green rectangle (202). Virtual objects are also known as user interfaces (UI) in some contexts. Light-emitting diodes (LEDs) (204) may be positioned along the periphery of the eyewear and can be used to signal to or communicate with the user.

Fig. 2B illustrates the superposition of the user's field of view, represented by the yellow rectangle (206), with the virtual objects under unoptimized eyewear dimensions. It is seen that the unoptimized FoV does not fully include the virtual objects and also fails to cover all the LEDs.

Fig. 2C illustrates the user's FoV, the pink rectangle (208), after the nose-bridge width and the depth of the eye-wear are optimized based on measurements of the user's IPD. It is seen that the optimized FoV includes the virtual objects, and also covers all the LEDs.

Fig. 2D illustrates another technique of matching the position of the virtual objects to the user's FoV. In this technique, the virtual objects (210) are compressed to fit into the user's FoV. Typically, this technique is used to resolve any residual virtual object mispositioning after adjustment of eyewear dimensions. LEDs that are outside of the FoV are turned off.

Further to the descriptions above, a user is provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein enable collection of user information (e.g., information about a user's social network, social actions or activities, profession, a user's preferences, or a user's current location), and if the user is sent content or communications from a server. In addition, certain data is treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user's identity is treated so that no personally identifiable information can be determined for the user, or a user's geographic location is generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. The IPD of the user is measured with specific user permission for improving the user's augmented reality experience while using AR eyewear. The user can deny such permission, in which case the AR eyewear uses default settings. Thus, the user has control over what information is collected about the user, how that information is used, and what information is provided to the user.

CONCLUSION

This disclosure describes AR eyewear that (with user permission) automatically measures the IPD of a user and adjusts its depth and width to match the user’s IPD. The user facing interface is personalized based on the physical FoV of the user’s eyes.