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Health and Safety Reminders Via Augmented Reality Glasses

Ruofei Du

Shengzhi Wu

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Health and Safety Reminders Via Augmented Reality Glasses

ABSTRACT

With the proliferation of personal electronic devices, the time individuals spend using their devices is an increasing concern. In particular, users may unconsciously spend too much time looking at a screen; their eyes may be too close to a screen, leading to eye strain; their posture may be suboptimal, leading to back or neck strain; etc. This disclosure describes techniques to leverage depth information detected with user permission via one or more sensors to determine when such situations occur and to provide suitable reminders to users, e.g., via augmented reality (AR) glasses.

KEYWORDS

- Eye comfort
- Eye safety
- Depth estimation
- Depth sensor
- Safety reminder
- Augmented reality (AR)
- Mixed reality (MR)
- AR glasses

BACKGROUND

With the proliferation of personal electronic devices such as smartphones, tablets, personal computers, wearable devices, etc., the time individuals spend using their devices is an increasing concern. In particular, users may unconsciously spend too much time looking at a screen; their eyes may be too close to a screen, leading to eye strain; their posture may be suboptimal, leading to back or neck strain; etc. Augmented reality technologies exist that can infer in real-time the depth profile of an image for objects within the image that are within a certain distance, e.g., 8 meters. Such technologies can be implemented on a wearable device such as augmented reality (AR) glasses.

DESCRIPTION

This disclosure describes techniques to leverage real-time depth information as detected by augmented reality (AR) glasses to offer health and safety reminders to users. The described techniques are implemented with specific permission to utilize depth sensing capabilities and to provide reminders. Users are provided with options to turn off the depth sensing and/or reminders at specific times, at specific locations, or based on other criteria. Clear indications are provided when depth sensing is performed and reminders are shown in the form of notifications that can be provided safely while the user is using the AR glasses.

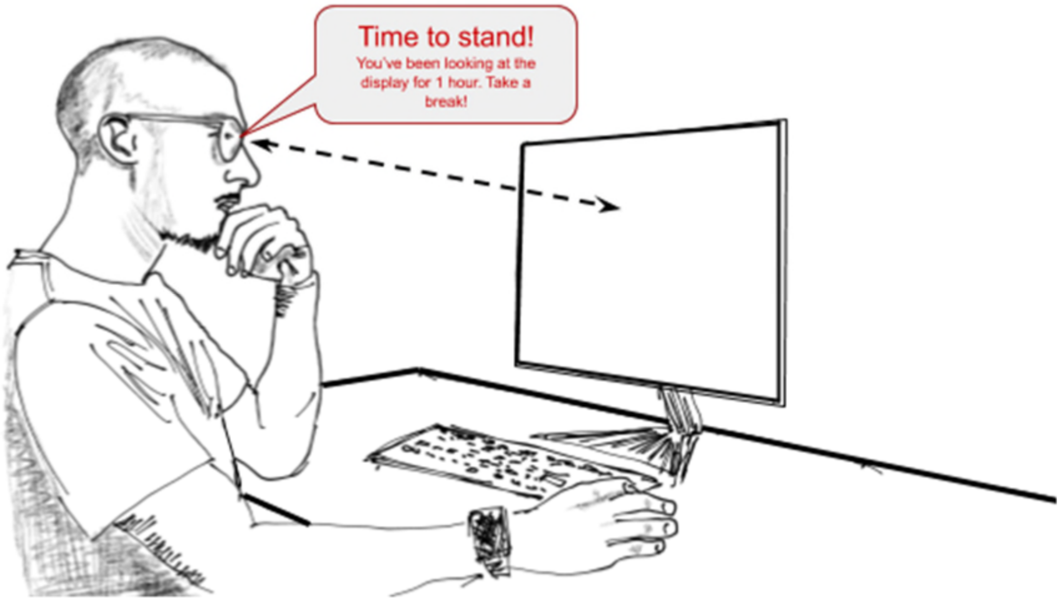


Fig. 1: A reminder to take a break from the screen

Fig. 1 illustrates an example application of the techniques described herein. With user permission, sensors on the AR glasses worn by the user are utilized to detect that the user has been looking at the screen for a while (e.g., continuously for longer than a threshold time). Upon such detection, a short reminder to take a break is projected via the AR glasses, e.g., as an AR overlay.

Fig. 2: A safety and comfort suggestion to view the book at a more appropriate distance

Fig. 2 illustrates another example application of the techniques. With user permission, the sensors on AR glasses worn by the user detect that the user is reading a book that is held too close to their eyes and project a suggestion to move the book further from the eyes.

Fig. 3: A safety and comfort suggestion to adjust pose

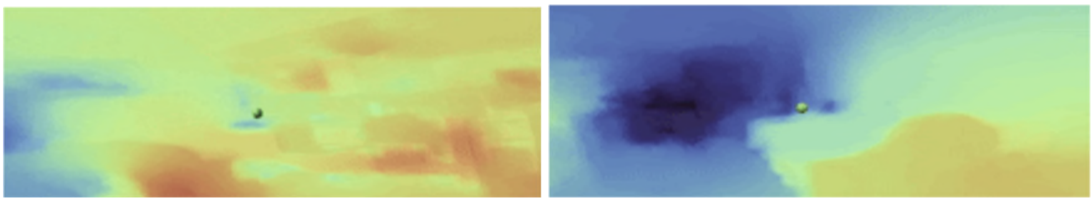
Fig. 3 illustrates another example application of the techniques. In this example, the user is poised on the sofa such that the user's back is on the seat of the sofa and the user's feet are mounted over the back of the sofa. With user permission, sensors such as an inertial measurement unit (IMU) and distance sensors that are included in AR glasses worn by the user are utilized to detect that the user is reading a book at an unusual pose. A notification is projected on the glasses suggesting that the user adjust their pose.

The notifications to adjust distance and/or posture, to take a break etc., can be rendered via an animated icon and text that pops us as an augmented overlay provided via the AR glasses. A snooze feature can be provided to enable the user to temporarily postpone the notification, or to temporarily disable notifications.

Some example applications of the techniques include:

- Reminding users to keep a distance from the monitor or books. The techniques can also be integrated into fitness apps, reminding people if they are too close to a screen/reading material for a long time.
- Preventing eye strain. If a user is closer than a certain distance to a display screen such as a laptop screen or a monitor more than a threshold duration, the user is reminded to walk around and then come back to the desk.
- Correcting posture. An IMU embedded within the AR glasses can detect if the user is bending their neck based on orientation data produced by the gyroscope. When poor posture is detected for a threshold time, the user is reminded to change to a better posture. As mentioned earlier, depth data from the AR glasses can be used to determine the distance of the book from the eyes and informs the determination of user pose.
- Users are provided options to provide the AR glasses with user-specific parameters, e.g., that the user has visual or motor impairments. Such users are informed of obstacles on their paths ahead.
- Users taking photos are informed if their subjects are too close, too far away, or within an optimal focal distance. For example, for portrait mode, the best distance for an artistic view is around 4 meters, while going below 1.5 meters can result in unnatural distortions.
- While in a queue or other social situation, the distance between the user and other people is determined, and if less than the distance recommended by health authorities, the user is reminded to maintain adequate social distance.

Determination of the depth of objects in an image



(a) **(b)**

Fig. 4: Examples of the depth maps obtained on augmented reality glasses. Blue indicates distances further away, red indicates distance closer to the eyes, and yellow indicates intermediate distances.

The depth of objects in an image can be obtained by various techniques. For example, augmented reality applications based on mobile computer vision enable the determination of depth maps in an image from a single moving camera in real-time. Fig. 4(a) and 4(b) are examples of depth maps generated by AR techniques. In this figure, blue indicates distances further away, red indicates distance closer to the eyes, and yellow indicates intermediate distances.

Fig. 5: Another example of a depth map

Fig. 5 illustrates another example of a depth map, where the depth map is superimposed over an underlying image. In the background is a computer monitor, and in the foreground, a desk. The darker red regions indicate regions, e.g., the desk, closer to the user. The lighter red regions indicate regions, e.g., the computer monitor, that is further away from the user.

Depth maps in an image can also be obtained with LiDAR sensors, infrared cameras, use of structured light, eye trackers, etc. One or more such technologies can be provided in the AR glasses and can be utilized with specific user permission. For example, with an eye tracker, a ray is cast from the user's eye positions (estimated by an offset from the camera) to the observed geometries in the field of view to determine the minimal length of the distance. Alternatively, N rays can be cast from the eye, each slightly rotated around the eye gaze direction, and the depth determined as the average of the N rays.

Without an eye tracker, the largest plane detected by AR techniques can be assumed to be the plane of the monitor or the book that the user is looking at. A semantic understanding module which can run in the background and identify the types objects in a field of view, can enable further discrimination of the object the user is looking at as a monitor, a book, or something else. Such a semantic understanding module may be limited to positive detection of certain types of objects (e.g., book, monitor, etc.) that are of interest with reference to health reminders and classify all other objects as other. Users are provided with options to enable or disable semantic understanding, or restrict it to specific types of objects.

The screen center can be a reference point to determine how far the user is from the monitor or book. The user's gaze direction and depth value can be filtered, e.g., with a Kalman filter, to achieve robustness and accuracy.

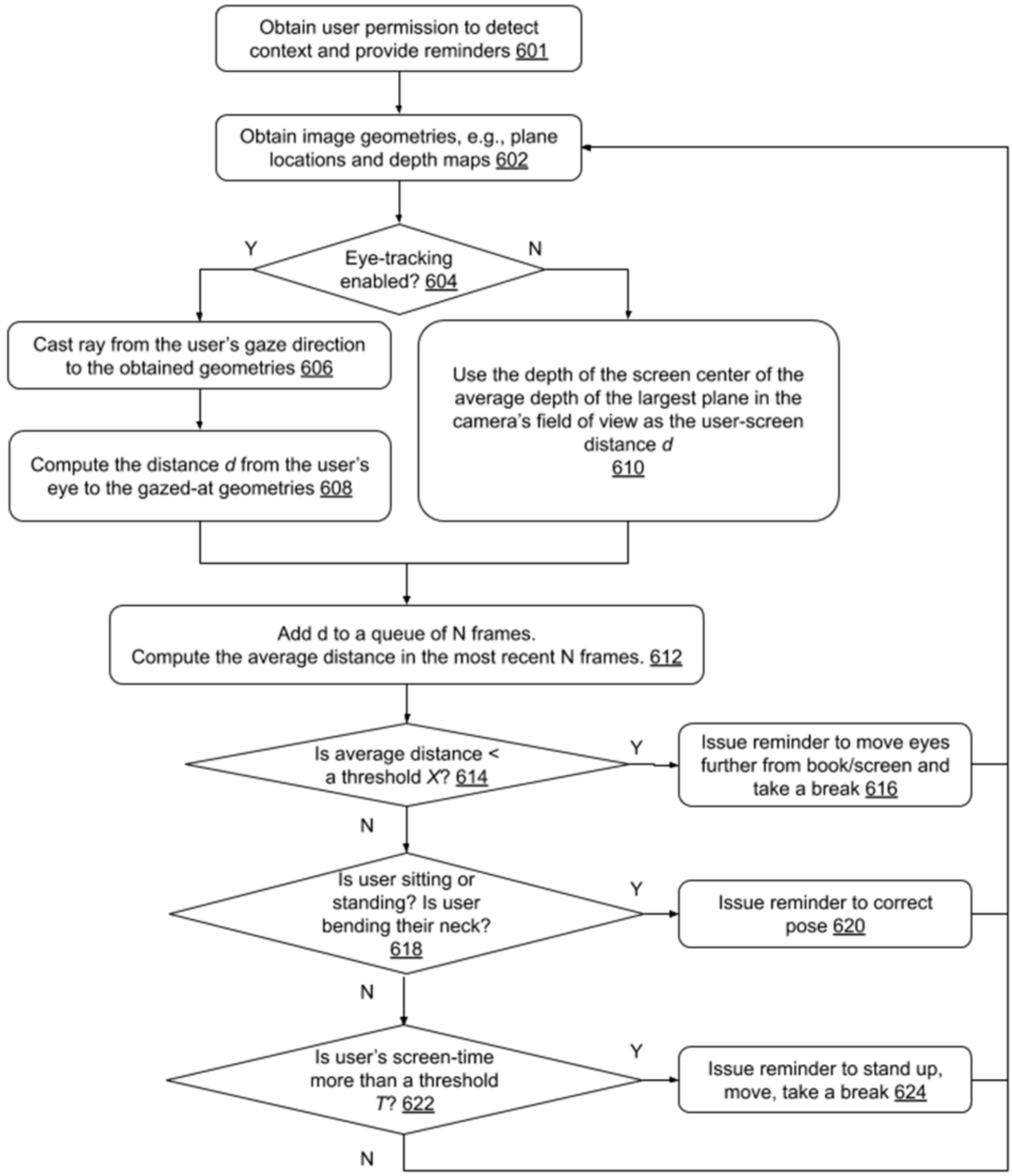


Fig. 6: Issuing health and safety reminders using AR glasses

Fig. 6 illustrates an example process to automatically detect if a notification is to be provided to users who are working in front of a monitor/screen or reading a book while wearing

AR glasses. User permission is obtained (601) to detect context using one or more sensors (e.g., that may be part of their AR glasses or other device). Image geometries, e.g., plane locations, depth maps, etc., are obtained (602) using augmented reality techniques, LiDAR sensors, infrared cameras, structured light, eye trackers, etc.

If eye-tracking is enabled (604), rays are cast from the user's gaze direction (606) to the obtained geometries and a distance *d* computed from the user's eye to the gazed-at geometries (608). If eye-tracking is not enabled, then the average depth of the center of the largest plane (screen) in the field-of-view is taken as the user-screen distance (610). While Fig. 6 shows eye tracking and depth estimation as separate, alternative ways of determining distance, the techniques can also be used together, and/or in combination with other depth estimation techniques.

The user-screen distance *d* is averaged over *N* frames (612). If the average distance is less than a threshold *X* (614), a reminder is issued to the user to move their eyes further from the book or screen and/or to take a break (616). If the user is detected (using signals from an onboard IMU, gyroscope, altimeter, etc.) as sitting or standing with an improper posture, or bending their neck (618), a reminder is issued to the user to correct their pose (620). If the user is detected as having spent more time looking at a screen than a certain threshold *T* (622), a reminder is issued to the user to stand up, move, or take a break (624).

The techniques described herein can work in a standalone manner (e.g., a single camera on AR glasses) or be combined with eye-tracking, IMU information, etc., to detect if the user is too close to a monitor, screen, book, etc.; if the user is maintaining a poor posture; if the user is looking at the monitor or book for a too long a time; etc. The described techniques can be applied in a variety of wearable device platforms, e.g., AR glasses, head-mounted devices

(HMDs), AR caps, hand-mounted devices, other wearable devices, smartphones with AR capabilities, etc.

Detection of contexts in which reminders are useful is performed locally on-device. Data from the sensors used to detect distance to the screen or book is analyzed locally and is not stored beyond the current session. Analysis of the data obtained through various sensors is performed locally, e.g., using on-device machine learning models, heuristics, or other techniques. Reminders are generated and provided locally. A record of the reminders (or lack thereof, indicating that no triggering circumstances were detected) is not kept, or is kept locally on the user's device. If the user provides specific personal information, e.g., related to their visual acuity or other relevant information, such information is utilized locally for the specific purpose of reminders as described herein. Users are provided with suitable controls, e.g., via a displayed user interface, via voice commands, etc. to configure whether and how the described techniques are implemented and to manage their data.

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 may enable the collection of user information (e.g., information about a user's posture, objects in the field of vision, 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 may be 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 may be treated so that no personally identifiable information can be determined for the user, or a user's geographic location may be 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. Thus, the user may have control over what information is collected about the user, how that information is used, and what information is provided to the user.

CONCLUSION

With the proliferation of personal electronic devices, the time individuals spend using their devices is an increasing concern. In particular, users may unconsciously spend too much time looking at a screen; their eyes may be too close to a screen, leading to eye strain; their posture may be suboptimal, leading to back or neck strain; etc. This disclosure describes techniques to leverage depth information detected with user permission via one or more sensors to determine when such situations occur and to provide suitable reminders to users, e.g., via augmented reality (AR) glasses.

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