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# Projection Using Augmented Reality Glasses to Prevent Image Capture

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# Projection Using Augmented Reality Glasses to Prevent Image Capture


## ABSTRACT

This disclosure describes wearable devices, e.g., augmented reality glasses, with built-in projectors and/or LED displays that enable a user to specify their privacy preference and prevent image capture by other devices that are proximate to the user. The projectors, e.g., diffractive optical element (DOE) projectors are used to emit coded light that encodes a pattern that signals the user's privacy preferences. Further, dithering projectors can be used to corrupt or limit the imaging area of a camera that is proximate to the user blanketing the wearer's face with projected light. A wearer of glasses as described herein can switch between a cognito mode and an incognito mode. The glasses provide user privacy from image capture via other devices in the user's proximity. The described techniques are suitable to provide privacy from devices that are on the same platform as a user's AR glasses and devices that are on other AR platforms.



## KEYWORDS

- Diffractive optical element (DOE)
- Dithering projector
- Incognito mode
- Coded light
- Privacy
- Augmented reality (AR)
- AR glasses
- Face recognition

## BACKGROUND

Augmented Reality (AR) wearables such as glasses provide an enhanced experience to users. AR glasses typically include cameras that capture images of the world near the user that wears the glasses. The images that are captured can include both animate and inanimate objects present in the visual field of view (FoV) of the cameras. Image segmentation and feature extraction are performed on the captured images to locate and identify objects in the environment. Along with inanimate objects, individual persons that are in the FoV can also end up being included in the image segmentation and feature extraction without their consent. Such image capture and extraction can also be performed by other devices such as a smartphone, a watch, or other device that includes a camera.

## DESCRIPTION

This disclosure describes the use of augmented reality (AR) glasses with built-in projectors, e.g., diffractive optical element (DOE) projectors to enable users to specify their privacy preferences and prevent others in the user's vicinity from capturing an image of the user, unless the user provides permission for such image capture.

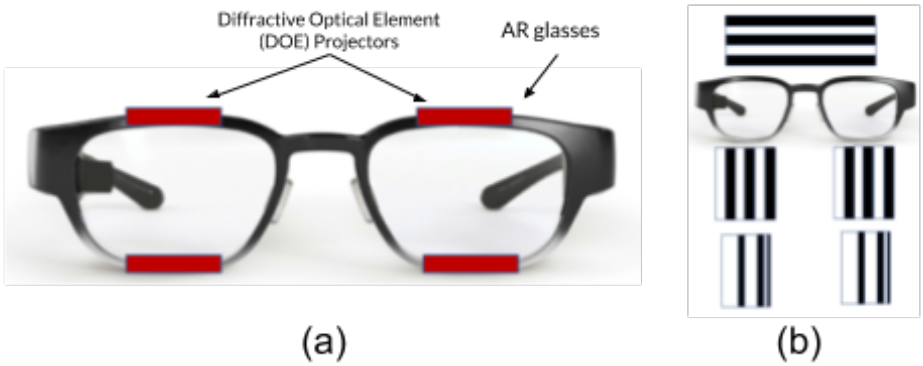


**Fig. 1: (a) AR glasses with DOE projector(s); (b) example projected pattern**

Fig. 1(a) illustrates an example of AR glasses that include dithered diffractive optical element (DOE) projectors. The projectors are mounted on the upper and lower portions of the AR glasses. The DOE projectors can project visible and/or infrared (IR) light. The projected image can include unique patterns, e.g., Quick Response (QR) codes, that enable a user to specify their privacy preference. Fig. 1(b) illustrates an example of a pattern that can be projected.

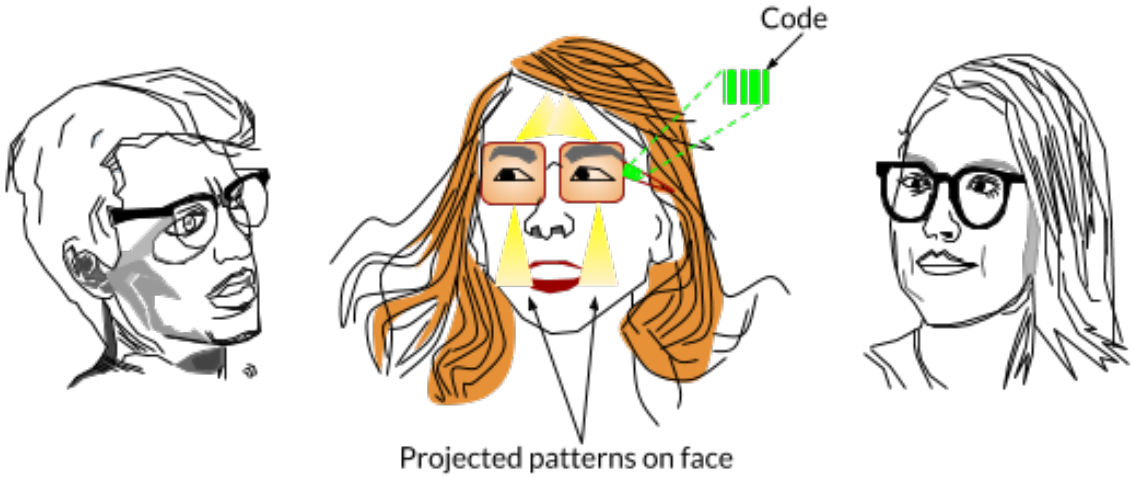


**Fig. 2: AR glasses can be used to indicate participation or block identification**

Fig. 2 illustrates an example of AR glasses being utilized in different modes to indicate user participation and/or to block extraction and identification of user facial features, based on user preferences. For example, the user can specify a preference for complete privacy such that any device, e.g., another user's AR glasses, or other camera, that obtains the user's image is not permitted to perform image analysis. In another example, a user can specify a preference for selective privacy such that only devices that belong to a user's friends (or known contacts) are permitted to perform image analysis.

**Passive mode**

In a passive mode, an image of a QR code (or other code) is displayed on a corner of the frame of the AR glasses, shown in green on the left corner of the AR glasses in Fig. 2. The QR code is indicative of the user's preference and can be read and processed by AR glasses worn by other proximate users. For example, an infrared light emitting diode (IR LED) can be utilized to display the QR code.

Alternatively, the indication can be provided by use of the on-board projectors of the AR glasses to illuminate the AR glasses with a unique code, e.g., a QR code or other binary pattern, in infrared light. The projected pattern (coded light) encodes information that provides an indication of the user's privacy preference to other devices that detect the pattern. Further, the pattern can encode information that identifies the user.

A limitation of this approach is that such indicators only work when other devices that attempt to perform image capture are on the same platform as the user's AR glasses, and recognize and respect the provided indication. Further, the unique code can also serve as a user ID in an augmented reality metaverse of different users or other virtual shared spaces.

**Active mode**

In an active mode, projectors on the AR glasses are utilized to project features on portions of the user's face. As can be seen in Fig. 2, the projected patterns (shown in yellow on the forehead and cheek portions of the face) serve to obscure the user's facial features. The projectors on a user's AR glasses can be used to blanket key portions of the user's face with features, e.g., projected in the infrared or visible light spectrum.

For example, the projectors can be activated upon detecting an image capture device, e.g., a capturing user's AR device, in the vicinity of the user. The dithering projectors can project on the wearer's face to corrupt and/or limit the imaging area of the capturing user's AR device such that facial features cannot be extracted from the captured image. The projected light can encode a binary pattern or a pseudorandom pattern using cosine/chirp functions.

A user that wears AR glasses with projectors as described herein can selectively switch from a cognito mode in which the user's image can be captured and recognized to an incognito mode in which the user's image cannot be captured. The AR glasses provide user privacy from image capture via other devices in the user's proximity. The described techniques are suitable to provide privacy from devices that are on the same platform as a user's AR glasses and devices that are on other AR platforms.

## CONCLUSION

This disclosure describes wearable devices, e.g., augmented reality glasses, with built-in projectors that enable a user to specify their privacy preference and prevent image capture by other devices that are proximate to the user. The projectors, e.g., diffractive optical element (DOE) projectors are used to emit coded light that encodes a pattern that signals the user's privacy preferences. Further, dithering projectors can be used to corrupt or limit the imaging area of a camera that is proximate to the user blanketing the wearer's face with projected light. A wearer of glasses as described herein can switch between a cognito mode and an incognito mode. The glasses provide user privacy from image capture via other devices in the user's proximity. The described techniques are suitable to provide privacy from devices that are on the same platform as a user's AR glasses and devices that are on other AR platforms.