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Ring-like Wearable Device for Interaction with AR/VR Glasses

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ABSTRACT

This disclosure describes a wearable device with a ring-like form factor that can be used to enable user interaction with AR/VR glasses and other devices. The ring-like device is lightweight, has a small form factor, and enables the user to discreetly interact with the AR/VR glasses. The device includes components such as a microphone, a context-aware touchbar, a battery, an antenna, an Inertial Measurement Unit (IMU)/magnetometer, etc. User inputs to the ring-like device are transmitted wirelessly via a microcontroller of the device. Multiple output modalities can be supported, e.g., haptics vibration, speaker, flexible display, etc. The ring-like wearable device can offer additional functionality such as navigation, user identification, payments, health monitoring, etc.

KEYWORDS

- Wearable device
- Wearable ring
- Hand gesture
- Finger gesture
- Gesture input
- Augmented reality (AR)
- Virtual reality
- AR glasses

BACKGROUND

Augmented Reality (AR) and Virtual Reality (VR) wearables such as glasses provide an enhanced visual experience to users. AR/VR glasses typically utilize hand gestures, gaze, and/or

voice as modes of user input to control the AR/VR glasses. In some situations, the use of hand gestures as an input mode can be cumbersome.

For example, performance of hand gestures within the field of view (FOV) of the glasses can obstruct a wearer's view of the surrounding environment. Performing such gestures can be difficult in some circumstances, e.g., when the wearer is running. In another example, performance of hand gestures in social settings to interact with AR/VR glasses can be awkward for the wearer. Voice-based or gaze-based control can require the user to learn to use these modalities, each of which has a learning curve. Alternative and complementary user interaction (input and output) methods that are quick and discreet can enhance user experience with AR/VR glasses and other devices.

DESCRIPTION

This disclosure describes a wearable device with a ring-like form factor that can be used to enable user interaction with AR/VR glasses and other devices. The ring-like device is compatible with various computing devices, including AR/VR glasses and can be used as a controller for such devices. The ring-like device is lightweight, has a small form factor, and enables the user to discreetly interact with the AR/VR glasses. The ring-like device can also be worn as a fashion accessory.

The ring-like device can be configured to support several input modalities such as, for example:

- Physical buttons for discrete operations (e.g. switching the glasses on/off)
- Scrolling for continuous manipulation (e.g. scrolling through a menu of choices)
- Air mouse using three degrees of freedom (3DoF) orientation tracking

- Hand and finger gesture recognition
- Swipe detection (e.g. by a thumb)
- Double-knock detection
- Voice inputs

The device also enables augmented hand tracking that utilizes improved precision and reduced latency of improved 6 degrees of freedom (6DoF) tracking and surface contact detection. Multiple output modalities such as haptics vibration, speaker, or flexible display can be provided.

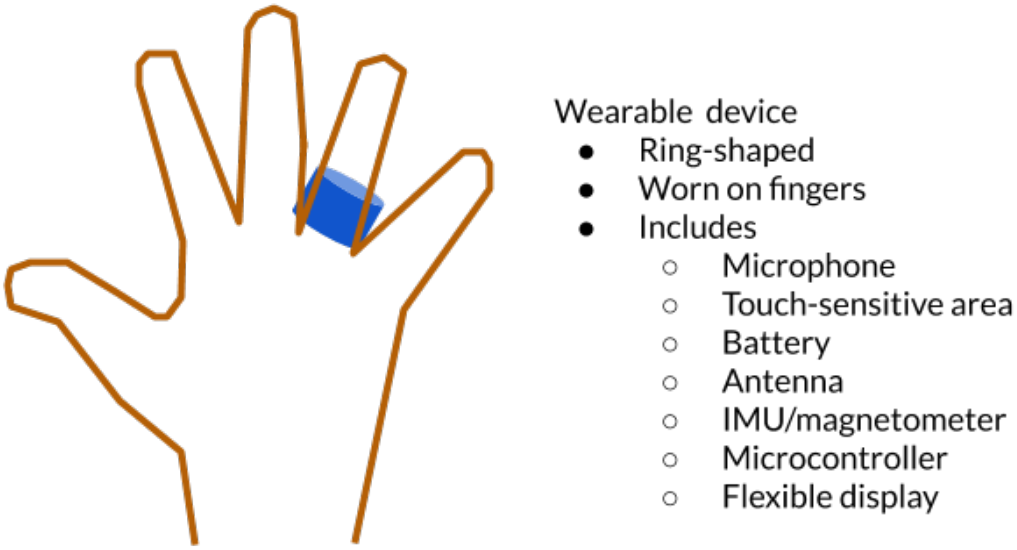

Fig. 1: Ring-like wearable input device for AR/VR glasses

Fig. 1 illustrates an example ring-like wearable input device for AR/VR glasses. The ring-like input device includes components such as a microphone (to receive voice input), a context-aware touchbar (to sense touch commands), battery, an antenna that enables wireless communication, for example, via Bluetooth Low Energy (BLE), and a Inertial Measurement Unit (IMU)/magnetometer (to determine hand and/or finger orientation), etc.

A slot or gap is provided for the ring-like device to be slipped over a user's finger(s). The ring can be worn around one or more fingers. For example, the ring can be designed with dimensions such that it can be worn around two fingers. This provides a larger interactive surface that can make it easier for a user to provide inputs and provides sufficient area to house the various components. Users may wear the ring placed around the ring finger and the little finger (pinky finger). This is advantageous, as these fingers tend to move together due to anatomical factors. Alternatively, the ring can also be designed to be worn around a single finger. Still further, the ring-like input device can be made such that it can be worn as a bracelet around a user's wrist.

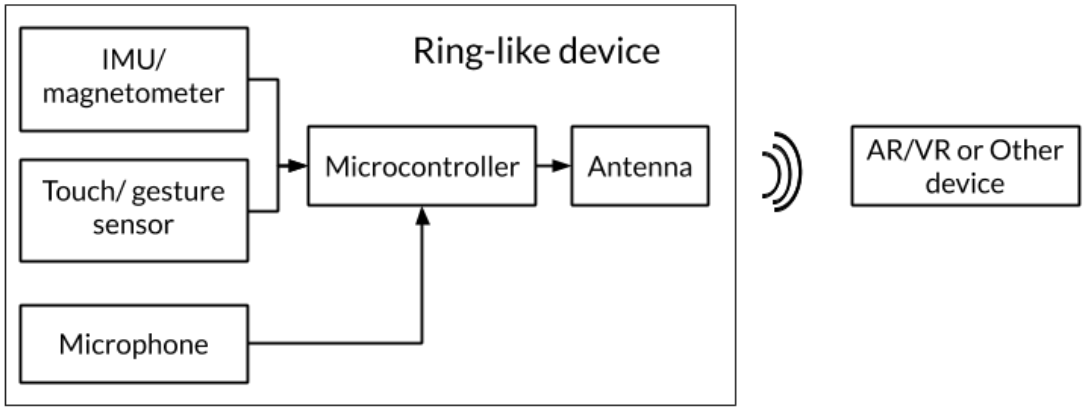

Fig. 2: The ring-like device can be used as a controller for an AR/VR or other device

Fig. 2 is a block diagram that depicts an example ring-like wearable device. User inputs detected by a IMU/magnetometer, touch/gesture sensor, microphone, etc. are transmitted to a microcontroller (MCU) for processing. Based on the processed inputs, the microcontroller transmits commands wirelessly to an AR/VR or other device via an included antenna. The wireless transmission can utilize a Bluetooth Low Energy (BLE) or other suitable communication protocol.

The recipient device translates the received commands to suitable actions. Commands can also be transmitted wirelessly from the AR/VR glasses or other device to the ring-like wearable device. These commands are translated to outputs, e.g. haptic feedback or display by the ring-like wearable device.

Examples of use

Subtle Interaction: A user Joey is chatting with Brian in a coffee shop and his AR glasses show an incoming call. Without calling attention to himself, Joey taps the ring to direct the call to voicemail, while continuing the conversation with Brian. A context-aware touchbar on the ring device detects swipes and taps from the wearer and performs corresponding actions.

Finger gesture interpretation: A user Kathy is jogging and wants to launch the music player made available through her glasses. Kathy double-taps the ring to activate it, swipes right to find the song, and swipes up to increase the volume. A context-aware touchbar on the ring detects finger gestures and interprets explicit user input, similar to a touchscreen.

Hand Gesture interpretation: A user Julie raises her hand to cover her mouth. A voice-based assistant is activated based on her gesture, as detected by the ring, and is ready for Julie's voice commands/queries. The Inertial Measurement Unit (IMU) of the ring detects the raise-hand-to-mouth gesture and initiates a context switch command.

Air Mouse: A user Ali sits on a couch, and projects a view from their AR/VR glass to a television. Ali uses the ring to navigate the menus and browse the internet. The IMU/magnetometer of the ring estimates device orientation, and the touchbar is utilized to detect swipes, taps, or other gestures.

Interactable Surface: A user Zihang wears the ring that is in communication with his AR glasses and taps four corners of his desk. In response, his AR glasses project a virtual workbench onto the desk. Zihang clicks the virtual buttons using his fingers. The IMU detects physical contact with the surface and augments the hand-surface interaction of the wearer.

Hand Tracking: A user Anita plays a game using her hands, while wearing the ring. The IMU enhances the fidelity of hand tracking by providing accurate orientation and touch detection.

The ring-like input device provides several advantages over other modes of interaction such as hand tracking, wristbands, hand-held controllers, and wearable pucks commonly used with AR/VR glasses.

- In comparison to hand tracking, the ring-like device provides an advantage of discreet operation, increased reliability due to reliable detection of physical contact, as well as haptics and visual output.
- The device offers higher fidelity haptics output and higher accuracy IMU-based finger gesture detection when compared to wristbands, and has a smaller form factor and is lighter than hand-held controllers and wearable pucks.

The ring-like wearable input device can also offer additional functionality such as navigation, user identification, payments, health monitoring, e.g., heart rate monitoring, activity tracking, sleep tracking, etc.

CONCLUSION

This disclosure describes a wearable device with a ring-like form factor that can be used to enable user interaction with AR/VR glasses and other devices. The ring-like device is lightweight, has a small form factor, and enables the user to discreetly interact with the AR/VR

glasses. The device includes components such as a microphone, a context-aware touchbar, a battery, an antenna, an Inertial Measurement Unit (IMU)/magnetometer, etc. User inputs to the ring-like device are transmitted wirelessly via a microcontroller of the device. Multiple output modalities can be supported, e.g., haptics vibration, speaker, flexible display, etc. The ring-like wearable device can offer additional functionality such as navigation, user identification, payments, health monitoring, etc.