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ADAPTIVE POSITIONING OF COLLABORATION DEVICE USING PATTERN RECOGNITION OF ACCESSIBILITY USER

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ABSTRACT

A collaboration device may include a large interactive display in the form factor of, for example, an interactive whiteboard. An interactive whiteboard may be a standalone touchscreen computer used independently to perform tasks and operations, or a connectable apparatus used as a touchpad to control computers from a projector. Conventional interactive whiteboards may present challenges for users with mobility or accessibility needs, especially for individuals who use wheelchairs, as they may be unable to reach the interactive whiteboard. Presented herein are techniques that enable an interactive whiteboard to recognize mobility or accessibility impaired users and to dynamically adapt the position of the whiteboard accordingly.

DETAILED DESCRIPTION

Collaboration devices that support presentation and annotation, such as interactive whiteboards, are typically mounted on a wall and positioned around one meter in height above the floor. While this placement is a natural position for most users to interact with the interactive whiteboard, it effectively prevents individuals in wheelchairs, individuals with reduced height, or individuals with limited mobility (sometimes collectively and generally referred to herein as “mobility or accessibility impaired users”) from using the device as they are unable to access the device in this position. This is illustrated in Figure 1, which depicts an illustrative mobility or accessibility impaired user, namely a wheelchair user, who cannot bring himself close enough to the device due to his wheelchair, and is thus unable to interact with the top half of the board.

Figure 1

While there are wall-mounted devices that allow for the position to be manually moved away from the wall and lowered or raised in height, such devices require manual intervention, which may greatly decrease the likelihood of utilization compared to a device that requires no manual interaction.

The embodiments presented herein may automate the positioning of a collaboration device like an interactive whiteboard, transforming it from a seldom-used manual feature into one which becomes an intrinsic attribute of the product. Furthermore, an interactive whiteboard capable of adaptive self-positioning may provide workplace inclusion to mobility or accessibility impaired users by including them in meetings in which they may not otherwise be able to fully participate in, or where there participation would cause disruption to the meeting as devices are moved to accommodate them.

Wheelchairs and other mobility aids possess clearly-identifiable patterns which a device can be trained to recognize. When a person using a mobility aid enters a meeting room, the collaboration device will pattern-match to identify which type of mobility aid is present, and therefore select an adaptive position that will best serve the user. The device may also be trained to detect users who do not rely on mobility aids, but who are short in stature, such as children or individuals with dwarfism.

When a user in a wheelchair moves toward a collaboration device, the device will identify them as a user who can benefit from an adaptive repositioning of the device, triggering the device to dynamically move to a lower position on the wall and/or a position that is away from the wall so that the user may access the entire area of the device's interactive screen from the user's wheelchair, as shown in Figure 2.

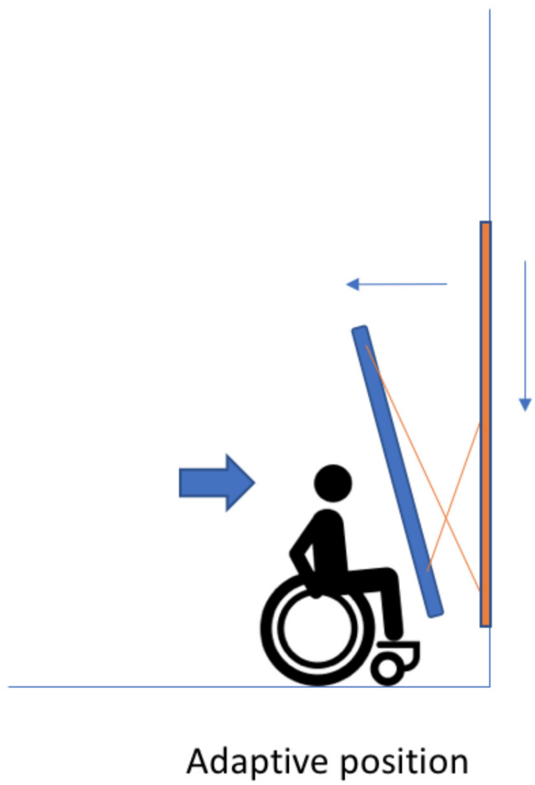

Figure 2

A tilt-forward action may also be included. The adaptive motion of the device may be achieved electromechanically via servo motors on the vertical and/or horizontal axes, which may be actuated in response to the user approaching the device. The device may also be fitted with discrete collision sensors to ensure that the device does not strike the user (or the user's wheelchair, other adjacent individuals, furniture, etc.) as the user approaches.

Once the user moves away from the device, the device may automatically return to a home or default position. However, since the device automatically recognizes the disability needs of users and dynamically adjusts itself accordingly, there is no need for manual adjustments to be made.

Since it may be difficult for a camera to determine that a particular user is a wheelchair user when the user is seated at a conference table, the collaboration device may make a determination that a user is in a wheelchair when the user moves towards the device. This enables the user's needs to be identified via pattern recognition when the user is in clear line of sight to a camera. Two primary pattern-matching opportunities occur when the user moves into the meeting room to take their position at the table, and as the user moves towards the collaboration device to use it. This ensures that the camera has an unobscured view of the user's mobility device, while also avoiding false pattern recognition that may occur when a user is static (such as a person sitting in a regular chair, which could be confused with a wheelchair) or when a user stands behind a chair and places their hand on it (which could be confused with a walking frame pattern). For example, Figure 3, which depicts a user sitting in a wheelchair at a conference table alongside other individuals, highlights the difficulty in determining which individual is in a wheelchair.

Figure 3

When unobstructed, however, wheelchairs may be easily distinguished by their unique geometric attributes, as shown in Figure 4.

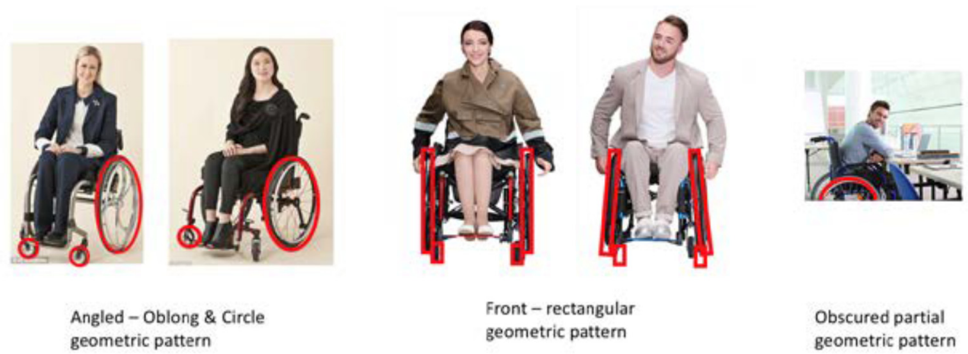

Figure 4

The large rear wheels and front small wheels of a wheelchair are well-defined geometric patterns that can be identified as the wheelchair enters the room and moves into position. Features of a wheelchair can also be recognized as distinct patterns when the wheelchair user is directly facing the camera (e.g., when the wheels of a wheelchair are uniformly positioned on either side of the chair seat). Partial pattern matches may also be recognized, e.g., when furniture blocks a portion of the wheelchair from the camera’s line of sight.

Various machine learning mechanisms may be used individually or in combination to achieve pattern recognition. Machine learning mechanisms to perform geometric shape detection are well-established and have been applied in applications such as vehicle navigation and obstacle avoidance. One example is the probably approximately correct (PAC) learning model for feature recognition (D. Roth, 2002), which can be used to identify the distinct shapes. PAC learning may be combined with a mechanism that recognizes that the wheelchair pattern maintains its integrity when in motion, which would eliminate false matches caused by the combination of people and room furniture (which could potentially resemble a user and their mobility device). Once such model is described in the publication “Model Based Vehicle Detection and Tracking for Autonomous Urban Driving” by Anna Petrovskaya, and Sebastian Thrun (*Autonomous Robots*, vol. 26, no. 2-3, 2009, pp. 123–139). This publication describes a mechanism for pattern recognition using a wheelchair as a specific example; however, the same mechanism can be applied to other devices (such as walking frames) that also possess well-defined geometric patterns and feature distinct patterns of motion.