JANUS

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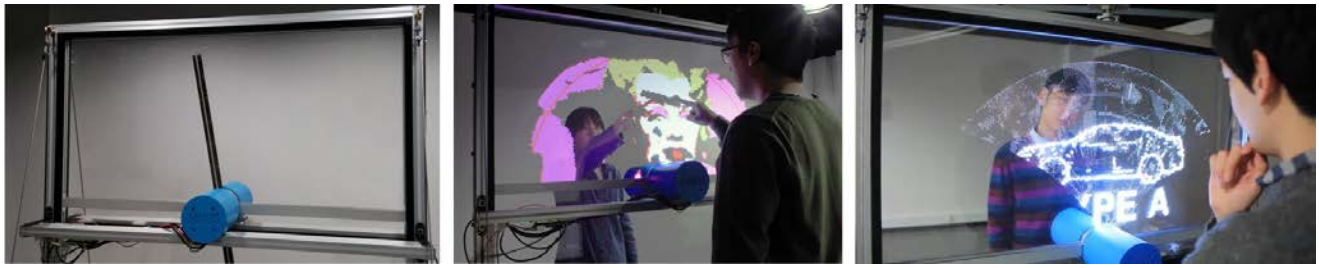

Figure 1: *(a) JANUS, (b) JANUS with paint application, (c) JANUS with image sharing application*

1 Introduction

Transparent display has already become an icon of the future. It is described in fancy ways in many movies; its transparency provides compelling visual openness. However, if every monitor is see-through, you would find yourself facing practical problems immediately after you start working with one of them. When you are writing e-mail, everything you do will be exposed to people in the backside. Lack of privacy is an inevitable drawback in transparent displays because people should have same images on both sides, which results lateral inversion problem. Lateral inversion can also cause a tricky problem especially when we utilize a transparent display for face-to-face collaboration as in TransWall [Heo et al. 2013]. Text on transparent displays can be read comfortably from one side, but would be hardly readable from the other side.
Transparent displays have great potential to be widely used in the near future, but the lack of privacy and lateral inversion might restrict its application. However, what if we have a display which is see-through yet opaque while it displays totally different images on two different sides of the screen? We named the display JANUS.

2 Implementation

The concept of JANUS is seemingly impossible, but it can be implemented by making use of the principle of POV (Persistence Of Vision) display. POV display generally consists of one-dimensional array of LEDs and it makes two-dimensional image in the air while spinning. We turn any moving object into a screen just by adding a POV display module on it [Mon 2014]. POV display is intrinsically see-through and its image can only be seen from one side where LEDs are laid out. In order to implement design concept, we devised a display which has arrays of LEDs on the both sides of a PCB blade. Mounted with infrared touch sensor frames, JANUS is a double-sided POV display with touch interaction (Figure 1-a).
JANUS has 96 tri-color LEDs on each side of its blade. The blade rotates at 1,000 RPM and spins in a plane of an 1149*1149 mm aluminum profile frame, which is covered by two sheets of plexiglass and infrared touch sensor frames (NEXIO ATI0500). A DC motor rotates the blade, and the power and signal for LEDs are supplied from outside of the spinning module via slip ring. When JANUS displays images on the screen, PC reads touch inputs. Then the computer generates visual feedback data for both sides and sends the image data to Raspberry Pi board. The board relays the data to both sides of the blade based on interrupt signal from an encoder wheel. The blade displays a line of image data for every one degree. The blade is thin, so transparency of JANUS is around 96%.

3 Application

JANUS has two separate graphic layers with directivity, so that collocated face-to-face interactions can be even richer. Users on each side can share an identical image on the screen and they can also see totally different images on the same spot. In former case, users can collaborate with same image while they can do independent tasks on same spot in latter case. People can control visibility of visual contents on the the screen to the other side at their convenience. As a result, we could solve lateral inversion problem of text on a display by using visibility control mechanism (Figure 1-c).
If user found a photo on the Internet, he or she can push the image and transfer it on the other side (Figure 1-b). JANUS can make traditional snake game more interactive. A player can control a snake and let it go through a hole. A snake appears on the other side and the other player has to finish his/her mission to get the snake back to the previous side. JANUS allows us to do pseudo 3D manipulations. If a globe is on the screen and we are rotating it to find something, one user can have Asia on the screen while another user is seeing America. JANUS gives an additional graphical layer between users, which can solve inconveniences caused by traditional transparent display. Expansion of virtual dimension in JANUS provides invaluable experience to users with its unique property.

References

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