Fluxa: Body Movements as a Social Display

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Fluxa: Body movements as a social display

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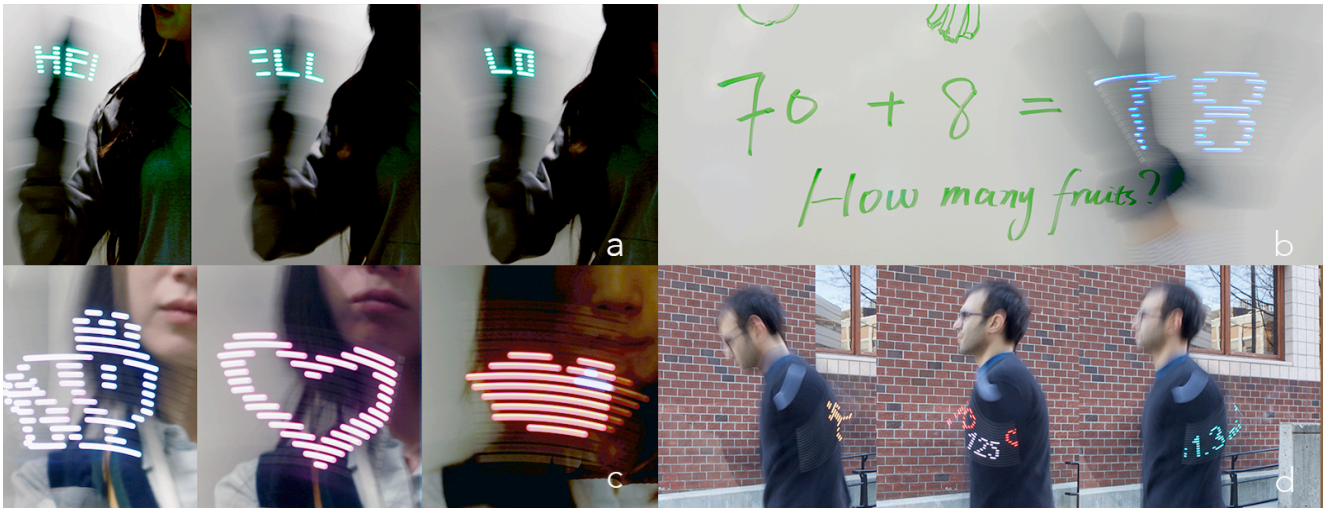

Figure 1: Fluxa: a POV display that foster social, physical interactions. (a. long-distance communication: "HELLO" text scrolling, b. overlaying display of an equation answer, c. image display in hand, d. showing biological data while running)

ABSTRACT

This paper presents Fluxa, a compact wearable device that exploits body movements, as well as the visual effects of persistence of vision (POV), to generate mid-air displays on and around the body. When the user moves his/her limb, Fluxa displays a pattern that, due to retinal afterimage, can be perceived by the surrounding people. We envision Fluxa as a wearable display to foster social interactions. It can be used to enhance existing social gestures such as hand-waving to get attention, as a communicative tool that displays the speed and distance covered by joggers, and as a self-expression device that generates images while dancing. We discuss the advantages of Fluxa: a display size that could be much larger than the device itself, a semi-transparent display that allows users and others to see though it and promotes social interaction.

Author Keywords

Wearables; persistence of vision; body movement; display;

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spatial-temporal interfaces, social display.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

To satisfy high demands for information accessibility and communication, a number of wearable displays have been developed to present information on and around users bodies [5]. The size of on-body displays is often limited by body shape, body motions and device weight. For example, smart watches [1, 12] and arm projections [6, 11] cannot exceed the width of the wrist. The use of wearable displays for social interactions has been touched upon by previous work. We can distinguish different social intentions: 1. notification and information display in public [8, 12, 14]; 2. enriching the dynamics of social interactions [7, 9, 10]; and 3. aesthetics and self-expression [3, 13].

A persistence-of-vision (POV) display utilizes movements to create an ephemeral display. POV displays have been popular among artists, hobbyists and even in the marketplace. People use POV for social entertainment and self expression, such as in the wheels of bicycles at night [4] and visual effects of performers their body extremities [2]. However, there are very few examples of POV wearable displays in an HCI context. Our aim is to explore the use of body movements as 1) a canvas for displaying

information, 2) actuators that make the display appear and disappear, and 3) a scalable display that depends on the length of the movement trajectory.

IMPLEMENTATION

The implementation supports four technical features: a flexible display area, translucency, malleable duration and full-color content. The hardware consists of three parts: 1. an LED strip of 16 full-color programmable LEDs (APA102); 2. a PCB consisting of a microcontroller (ATmega328), a 9 DOF sensor (LSM9DS0), an EEPROM (24LC256) and a Bluetooth LE board; 3. a 3D-printed container with magnets and Velcro on the back of the LED strip to attach the device onto clothing at various body locations.

The display can show both text and images. It consists of 16 rows (16 LEDs) by 21 columns, which displays a maximum of three letters of 7 columns each. We create different animation modes that can display the text and images in different ways. The information can be shown in the whole display (16 pixels/column) or scaled to a smaller size (8 pixels/column) with two lines of letters. We also have a scrolling animation that pushes text forward and backward, as well as a refresh animation with 10 sweeping movements each frame. We have also developed a mobile app that program and communicate with Fluxa through Bluetooth LE. The user can type in a message, choose different animation modes and customize the color, brightness and display duration of the information.

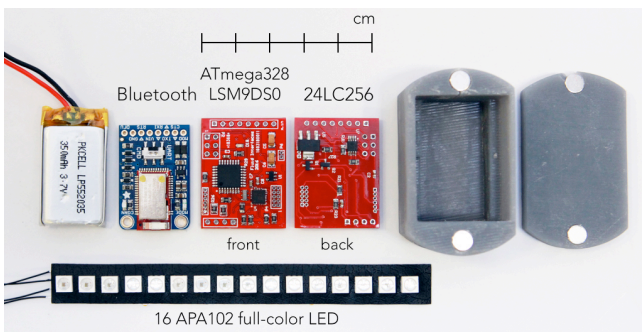

Figure 2. Fluxa Hardware

DEMO APPLICATIONS

A possible application for Fluxa is to visualize biological signals or other sensor data during activities. We have created a scenario in which users are able to see the distance traveled and users heart rate updated and streamed through our mobile terminal to Fluxa in real-time.

Another application is to embed visual information on top of user gestures to broadcast information in scenarios such as weaving hands towards a friend to call for attention, and long distance communication in the same physical space. The message generated by Fluxa is especially useful and readable for noisy or dark environments.

Other applications are done when coupling the interaction of Fluxa with real-life objects. A POV display essentially results from retinal afterimages, and is therefore able to show overlapping information on top of an object. In this way, Fluxa could reveal who is in a closed room when waving in that direction. Also Fluxa could be paired with a blackboard in teaching. When the teacher writes certain information on the board, for instance, a mathematical equation, he may use Fluxa to reveal the answer or supportive information that is not written yet.

CONCLUSIONS AND FUTURE WORK

The wearable displays proposed so far are mainly used for displaying information privately to the wearer. However, creating public wearable displays provides new possibilities to foster and enrich social interactions. In this paper, we presented the Fluxa POV wearable display which has been proven useful for several social interactions such as activities monitoring and sharing, group coordination, warnings in the public and superimposing information onto physical objects. In this way, this device promotes social interactions, informs and attracts people's attention in a playful fashion.

Unlike other wearable displays that only use the stationary body as the substrate, our system explores the use of body movements as 1) a canvas for displaying information, 2) actuators that make the display appear and disappear, and 3) a scalable display that depends on the length of the movement trajectory. Moreover, Fluxa offers unique advantages in that the display is semi-transparent and as such allows for augmenting physical objects. It creates ephemeral user interfaces that plot pixels in the air. In this way, information could be augmented onto someone's own body or onto surrounding objects. Another important advantage is that the device is much smaller than the display size it can produce, which makes it more usable in a mobile context.

Potential applications were presented as a proof of concept of this technology. Future work will explore communication among multiple devices to support social interaction such as gamification and group activities. We are also interested in the use of several Fluxa devices on different parts of the body. Other sensors such as infrared and RFID readers could be embedded for automatically recognizing and overlaying information onto physical objects.

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