HandON : A Tabletop Interface for Dynamic Erasable Handwriting

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1. Introduction

Today there are various studies and works using handwritten information. For example, “Drawn”[1] makes us not only draw but also move handwritten illustration with our hand. Furthermore, the author[2] developed handwritten input interface. These works provide us a performance that we have never been. The greatest feature of handwritten is that it has “handwriting” and that is also different from a character of computer. Handwriting is information reflecting personality as same as stature and voice quality. Thus, handwriting may be able to portray yourself. Personal features are limitless and others may be able to make result which you can’t.
We have developed loop sequencer using handwritten character which can disappear and move. Disappearing and moving are new elements in works using handwriting and the elements enable handwriting to behave interactively. We think our new kind interface enable audience to enjoy performance visually unlike conventional instrument and sequencer as well as proposes new play style.

2. Prototype

We obtained images of handwritten characters and recognized what kind of characters are written. After this, we erased the handwritten characters by Peltier device. Simultaneously, we projected the image of the handwritten characters on the paper and user could move handwritten characters projected with his finger and play sound when the characters hit others or edge of paper.

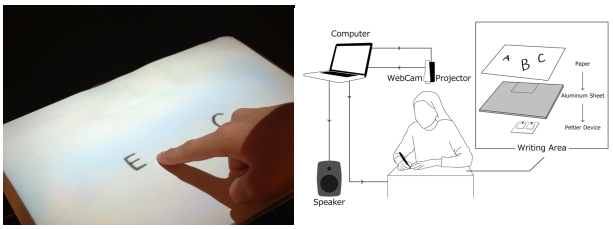

Figure 1. *left: Prototype of our work, right: System of our prototype*

3. Implementation

In this chapter, we explain our implementations to enable disappear, moving and sound handwritten character.
First, we explain erasing handwritten character. We used thermochromic ink pen[3]. The ink becomes transparent when it is heated up to about 60 degrees. In previous study, handwriting was erased by heat of laser[4], however, this method could not erase large surface. Accordingly, we heated up surface of paper with Peltier device (see Figure 2). Then, we cooled Peltier device of surface in contact with paper in order to ensure safety after erasing handwritten characters. Second, we explain moving characters with hand. We implemented finger tracking to move character with hand using image processing. We made binary image by skin detection and contour data from the image (see Figure 3). Furthermore, we obtained a convex hull with contour data and the vertex of convex hull by corner detection. This vertex is the tip of the finger we need. Handwritten characters were moved when this vertex hit it. Finally, we explain character recognition. In our work, we assigned characters optional interval according to German-style sound name. Figure 4 shows a result of this processing. Green rectangles are the handwritten characters cut out from an input image and put on the input image again. Red characters in the upper left corner of the green rectangle are a result of character recognition.

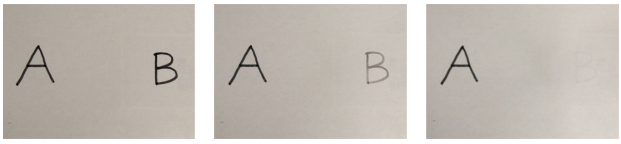

Figure 2. *A state of erasing handwritten character by Peltier device.*

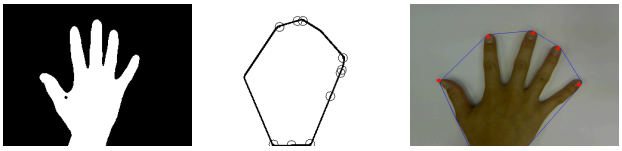

Figure 3. *left: A result of skin detection, center: Convex hull and corner detect from convex hull, right: A result of finger tracking by our algorithm*

Figure 4. *A result of character recognition.*

4. Future work

We should take advantage of the feature such as a shape, a line weight and size because we think it leads to the realization of a more natural and diverse interaction.

Reference

[1] Zachary Lieberman, “Drawn”, http://thesystemis.com/projects/drawn/ (2013.02)
[2] Tetsuaki Baba, Yuya Kikukawa, Toshiki Yoshiike, Tatsuhiko Suzuki, Rika Shoji, Kumiko Kushiyama, and Makoto Aoki, “Gocen: a handwritten notational interface for musical performance and learning music“, In ACM SIGGRAPH 2012 Emerging Technologies(SIGGRAPH ’12). ACM, New York, NY, USA, Article 9, 1 pages.
[3] POLOT, Friction ballpoint pen, http://www.pilot.co.jp/products/pen/ballpen/gel_ink/frixionball/ (2013.02)
[4] Kouhei Nishimura, Junghyun Kim, Takeshi Naemura, “AR-eLaser: Erasable Handwriting Interface with Paper and Pen”, IPSJ Interaction 2012, pp. 575 - 580(2012.3)

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