

# Touch Light Through the Leaves: A Tactile Display for Light and Shadow

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**Figure 1:** Left: Picture of "Touch Light Through the Leaves, Center Left: Tactile display with vibration units, Upper Center Right: Detection result of light and shadow by the camera and determination of vibration units, Lower Center Right: Side view of the tactile display, Left: System overview

**Keywords:** tactile display, interaction, sensor, light and shadow detection

## 1 Introduction

You can feel something good and comfortable when you turn your palms up and the light falling onto your palms through the trees. "Touch Light Through the Leaves" begins from an imagination which we can touch the light through the leaves. We propose "Touch Light Through the Leaves". It is a novel tactile camera display which can change visible information into tactile. It is not only a sensor of light and shadow but also a tactile display. You can feel the transition of light and shadow by your palms directly with it. You can touch the light and also can be touched by the light. Sound-Lens [Iwai 2001] is based on a similar idea. You can hear light with it. It can change light to sound.

In terms of a tactile display, there are several kinds of tactile display. For making tactile sensation to a palm, the way to use an air pressure with a speaker is proposed. An idea to make a tactile sensation to a palm is the same as our proposal [Hashimoto and Kajimoto 2008]. In terms of a tactile display for conveying information, the Optacon (Optical Tactile Converter) is one example. It consists of a small camera and pin display. It can convey information for blind people. We developed this idea and generate an entertainment and art device.

## 2 Our Approach and Implementation

This touch display can change from visible information to tactile information. It can transmit the light and shadow to your palm directly as a tactile. It consists of a camera and vibration units with in the same device. The camera can detect light and shadow and vibration units change them into tactile with image processing and control of each units with vibration motors. The size of this display is like a palm size in order to hold by a hand. The weight of this display is about 800g. This portability is required to experience under

various conditions.

The overview of system is three parts: 1) Tactile display: a camera and a tactile display, 2) PC: image processing and determination of vibration units, 3) Control unit: controlling vibration units. Each part is connected by USB or MIDI. A user bring only a tactile display for experience.

For a tactile display, we put 85 vibration units at the bottom of the device. For the vibration units, we used 85 vibration motors (vibration motor: 6dl05wa by Linkman). One unit consists a vibration motor with a plastic polyvinyl chloride cap with 6.0mm diameter. Each unit has 6.5 mm diameter. Each unit is distributed with 9.0 mm pitch. With 85 vibration units, it can stimulate a whole palm.

On the top of display, we put screen material in order to make shadow on it. A camera detects this shadow and light. For a captured image, we do noise reduction, binarize, and determine vibration points. The area of shadow or light determines vibration points. When you want to touch shadow, vibration units of shadow area will vibrate. When you want to touch light, vibration system works opposite by a parameter.

## 3 Results and Discussion

People who experienced this display had weird and new feeling because they can feel light or shadow directly. In their daily life, light and shadow are perfectly ordinary. When they feel light and shadow directly on their palms, it becomes a tactile sensor, which reminds them of light and shadow. For our future work, we want to develop more lightweight and wireless system for experiencing "Touch Light Through the Leaves" everywhere.

## References

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