# FlashTouch: Touchscreen Communication Combining Light and Touch

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Figure 1: a) A demo setup with mobile devices and FlashTouch modules, b) modules, c) communication visualization.

#### Introduction

FlashTouch is a new technology that enables data communication between touchscreen-based mobile devices. Touchscreen can be used as communication media using visible light and capacitive touch. We designed a stylus and small case modules for collaboration using touchscreens. With these modules, users can easily transfer data from one mobile device to another. This technology realizes non-wire or non-wireless communication just using touchscreen as a communication medium. The achievement of FlashTouch are summarized as following: 1) Easing data sharing only by using stylus device. Mobile device receives text data from touchscreen then there is no need for optional wireless or wired connection. 2) User identifies data sharing operation as like picking and dropping data by dropper. 3) User can capture data on the screen because it is displayed on screen to be operated.

## Technology

FlashTouch is implemented by digitalizing visible light and capacitive touch as communication media for data transmission. [1] The touchscreen emits digitalized visible light and a phototransistor senses the level of this light, which changes at a constant speed. Capacitive touch sensing can be used for sending binary data by switching touch status.

We used a relay switch to create a circuit between the touchscreen and the ground to digitize touch input. The conductor nib surrounds the phototransistor so that visible light input and capacitive touch output can be transmitted at one point on the screen. We selected NJL7502L (New Japan Radio Co., Ltd.) as the phototransistor; it is known as an ambient light sensor. A mono-color transistor is selected is reduce the transmission speed because touch sensing is not as fast as light transmission. Relay switch is OMRON's MOSFET relay that has low output capacitance. The microcontroller is a custom-designed AVR circuit with Arduino firmware.

#### **Touchscreen Communication**

FlashTouch was developed and tested using Apple iPhone 5s and iPad 3. During our tests, we discovered that the minimum reaction time of the devices to visible light was 0.02 s. As a relay switch controls capacitive touch, its minimum reaction time to detecting

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Figure 2: Principle of switching touch status.

touched and untouched states is 0.03 s. All byte code data is converted to binary from any data, for example ASCII character. For instance, if the character "A" is encoded to "0x41," represented as "01000001" in bits, the application emits visible white light as "1" or displays black as "0." On the other hand, capacitive touch should be enabled even if transmission is off. Receiving data "0" is expressed as an untouched state. Faster transmission can be implemented with channel multiplexing by adding an optional FlashTouch connection.

## **User Experience**

Our system lets user to pick and drop information shown on the display. Each item of information can be captured, memorized, and written by a FlashTouch module. Particularly, mobile applications should have a user-friendly interface to provide user proactive interaction. This UI prescribes a view area with information symbols, such as text and images, to work as the transmitters and receivers. Data areas where data such as text, color code, and id of icons are stored emit data from the screen to the stylus when the user places the device on the screen area.

we prepare two types of demonstration; 1) tablet-based application for drawing with pens and stamps, 2) showing communication with actual transaction in both of light and touch. User can experience fast and non-wire or non-wireless communication using just only touchscreen devices.

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#### References

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