# Active Click: Tactile Feedback for Touch Panels

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**ABSTRACT**

"Active Click" is a new interface mechanism for addling tactile feedback to touch panels. A small actuator is attached to a body of PDA or the backside of a touch panel. The tactile feedback, created by driving the actuator with a short pulse, is perceived by the grasping hand or tapping finger-tip when the panel is tapped. Active Click is effective in improving the input speed of touch panel operation especially in noisy situations. Active click is also useful for large touch panel devices such as public information terminals or ATMs.

**Keywords**

touch panel, click, PDA, interface device

**INTRODUCTION**

Touch panel displays are commonly used for PDAs because they are suitable for graphical and direct operation, and display size can also be increased through the deletion of keyboard buttons. However, ordinary touch panel devices fail to achieve comfortable and accurate operation because they do not provide the *click feel* when tapping. In many cases, a short beep sound is used to simulating the tactile click. However, this mechanism has many problems; for example, input mode (tactile tapping) differs from output mode (audible beep), and the beep sound may not be heard in noisy situations such as outdoor use.

"UnMouse"[1] is one solution for adding tactile feedback to touch panels. It uses the whole touch panel as a large push switch, however, nimble operation is difficult because the inertia of the push switch is large. "CC Click"[2] places transparent switch mechanisms over the display panel. The movable parts are small enough to operate airily, but switch position and display design are restricted.

**CONCEPT**

"Active Click" is a new mechanism that allows any touch panel device to provide tactile feedback. An actuator (electric to vibration transducer) is attached to a body of the PDA or the backside of the touch panel (**Figure 1**). When tactile feedback is desired such as tapping action by finger-tip, a short pulse signal is supplied to the actuator for making the actuator vibrate. The vibration is conveyed to the grasping hand or tapping finger-tip.

Figure 1: Example of actuator mounting
Putting actuator on the back panel of PDA.

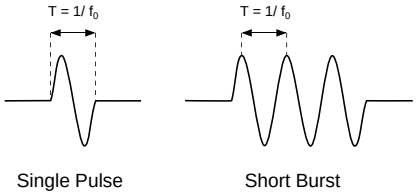


Figure 2: Example of driving signal for *click feel*.
$f_0$ = natural frequency of the actuator.

One commonly used vibrating device is a small motor that rotates an eccentrically weighted shaft. This approach cannot offer subtle control; only continuous vibration is well generated such as silent alarm of cellular phones. On the other hand, the structure of Active Click's actuator[i] is similar to a magnetic speaker, and delicate control is possible. For example, *click feel* is expressed by adding a single pulse or a short burst signal (**Figure 2**). Large vibration levels can be obtained using a small amplitude input signal if the pulse width or signal frequency equals the *natural frequency* of the actuator. In addition, the actuator can be used as *speaker* if the input signal contains audible frequency range. Therefore, both tactile feedback and audible output can be generated from just one device.

[i]TOKIN "MultiActor" [http://www.tokin.com]

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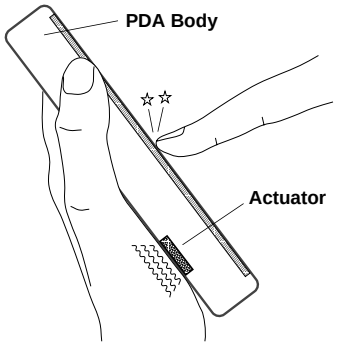
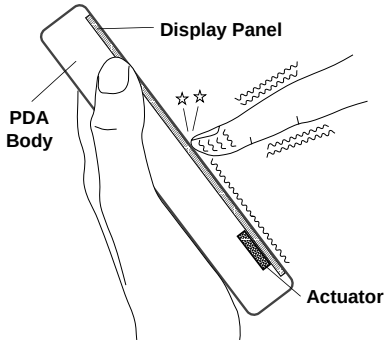
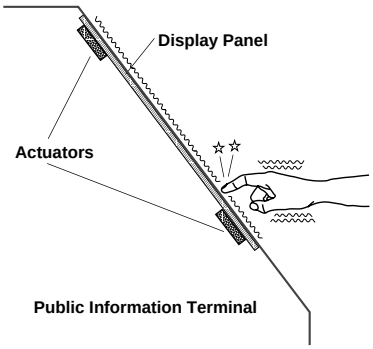
*Reference:*
FUKUMOTO, Masaaki and SUGIMURA, Toshiaki "ActiveClick: Tactile Feedback for Touch Panels" ACM CHI2001 Extended Abstracts, pp121-122, April 2001.




(a) Body mounted actuator for PDA.
Tactile information is conveyed to grasping hand.




(b) Panel mounted actuator for PDA.
Tactile information directly reaches tapping finger-tip.




(c) Panel mounted actuator for large display.
Large or multiple actuators are used.

Figure 3: Mechanism of Active Click

## VARIATION

Active Click has several variations according to the attaching position of the actuator. **Figure 3**-(a) shows the body mounted actuator for PDAs. Tactile feedback is conveyed to the grasping hand. Large feedback can be achieved with small amplitude input signal by attaching the actuator to the contact position of the grasping hand. This style is suitable for PDAs that requires low power operation.

**Figure 3**-(b) shows the panel mounted actuator for PDAs. The actuator is attached to the backside of the touch panel display. Tactile feedback is conveyed to the tapping finger-tip directly, so this style can express most natural click feel. However, power consumption is higher since the whole touch panel must be vibrated.

**Figure 3**-(c) shows the panel mounted actuator for large displays such as public information terminals or ATMs. In this case, power consumption is insignificant therefore adequate tactile feedback can be realized by using large or multiple actuator(s).

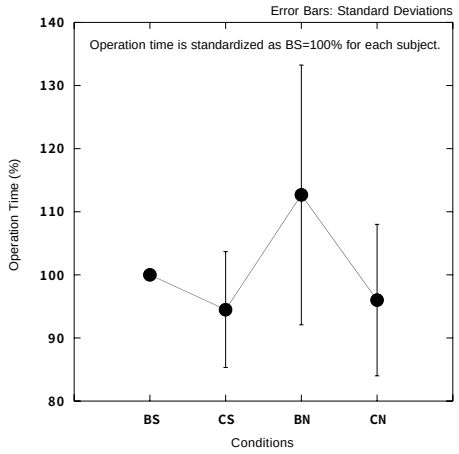



Figure 4: Time to perform calculating task.
Active Click is effective in reducing operation time.

## EVALUATION

Simple calculation task[ii] was set to verify Active Click's performance. *Palm* compatible PDA[iii] and Palm-OS standard *Calculator* application were used in the evaluation. Both operation time and correct answer rate were measured using either Active Click feedback (body mounted actuator) or ordinary beep feedback. Two noise levels[iv] were set to check the influence of environmental noise. Four situations ( [BS]: Beep&Silent, [CS]: Click&Silent, [BN]: Beep&Noisy and [CN]: Click&Noisy ) were tested for each subject. Presentation order was randomized to eliminate any learning effect; the number of subjects was 10.

Difference in operation time is shown in **Figure 4**[v]. This graph shows that Active Click can reduce the operation time by about 5% (in silent situation) and 15% (in noisy situation)[vi].

## CONCLUSION

Active Click can improve the usability of touch panels, especially in noisy situation, even though its mechanism is simple and easily implemented in ordinary PDAs. We are planning to create various tactile information by controlling the actuator's input signal, and to handle the feedback position by using plural actuators.

## REFERENCES

[1] "UnMouse" by MicroTouch Systems Inc.
[http://www.microtouch.com]
[2] "CC Click" by IDEC Corp. [http://www.idec.com]

[ii] One question: adding 5 pairs of 4-digit numbers, 20 questions in one task.

[iii] TRG Pro [http://www.trgnet.com]

[iv] 40dB(A) corresponds to a silent room, and 70dB(A) corresponds to an urban street. Pink noise was used as the signal source.

[v] Operation time was standardized as [BS] = 100% for each subject.

[vi] No significant difference was observed in the correct answer rate.