mobile vce

: research innovation application :

Pressure-based Input for Mobile Interaction

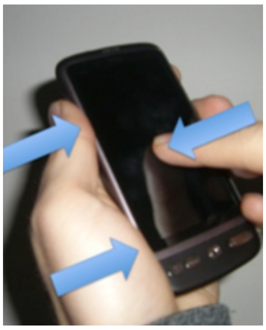
Industry brief

Strategic Business Relevance:

Pressure input through the fingers is a natural augmentation of existing multitouch & 3D spatial and gestural interfaces on mobile devices. It adds a third (z) dimension to 2D (x-y) touchscreens, and sensors round the device body can leave the screen clear of obstructions from fingers. It is an expressive and accurate input channel but until now hasn't been sufficiently applied or tested on mobile devices.

Enabling eyes-free mobile pressure interaction

Previous research on the use of pressure, or isometric force, through the fingers/hands as an input method has focused on desktop applications. Our research on the use of pressure for mobile interactions investigates which types of interaction pressure can help with, as well as if pressure input can be used while the individual is in motion (e.g. walking). Alternative grips/sensor positions are also being investigated, particularly focusing on whether non-visual interaction is feasible, to allow the user's visual attention to be paid to their environment.



Core Research: User Interactions for Breakthrough Services

This research addresses the ways in which users interact with portable and mobile devices, and with other devices in their physical and logical environments, in order to enable new types of personalised and highly contextualised services.

The pressure interaction research informs the development and evaluation of new prototype user interaction technologies.

Virtual Centre of Excellence in mobile and personal communications

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www.mobilevce.com

Enabling eyes-free pressure-based interaction on mobile devices while walking

Industry brief

Pressure input may fit with mobile interaction paradigms, but does mobility influence control?

In our prototype evaluations, input came from a single linearised force sensing resistor attached to the front of a mobile device, controlled using a pinch between the thumb (on top of device) and finger (underneath the device). Users controlled a cursor moving through a vertical menu (*a la* Microsoft Word etc). The sensor could detect approximately 4N and this space was divided into 4, 6, 8 or 10 menu items

Influence of Walking

Precision of pressure input was worse while walking, with more erratic input. This resulted in an increase in the number of wrongly selected menu items compared to sitting, but only from 1.7% to 3.1%. It also increased the length of time taken to select a menu item by an average of 0.6s (up to 3.1s). So, control of pressure while walking is highly feasible, although high accuracy is countered by slower interaction.

Visual vs Non-visual interaction

We had users control pressure using only audio feedback while sitting and walking. Performance using audio feedback was highly encouraging, with errors peaking at 13% while walking. Use of audio feedback increased selection time by up to 1.6s and was markedly more challenging to use. For menu applications, using a *Rate-based* control method (see below) lowered errors to 3% and lowered selection time by 1-1.2s. It was also much easier to use. Therefore, non-visual feedback, even when walking, can achieve near perfect accuracy.

The Effect of Control Method

We had users control pressure using only audio fln our research we compared the common *Positional* control method to a velocity or *Rate-based* control method, in order to identify which method allows for superior control of targeting while walking. Our results have shown that *Rate-based* control is faster, more accurate and less mentally and physically demanding for linear targeting than *Positional* input, when both sitting and walking.

Summary

So far we have found that mobile pressure-based interaction can be highly accurate, even more so than previous desktop implementations. Both visual and non-visual interaction is feasible, even when walking. In future work, we will investigate the use of tactile feedback and interactions using multiple digits and manipulation forms.

Industry focused research, innovation & application

Key Points

- Pressure input fits well into modern mobile interaction paradigms based on touch, gestural and spatial input.
- Mobile eyes-free interaction is highly feasible.
- Control of applied pressure while walking is very good, despite marginally lower precision and slower interaction time.
- Control using only audio feedback is also good, even when the user is walking, but suffers from reduced precision and interaction time.
- Use of a linearised pressure sensor improves control of output, as does use of spatialised audio around the head.
- Rate-based input improves performance in targeting applications.

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