The Apple Trackpad: Description, Features and Benefits (5/94)

Article Created: 3 May 1994

TOPIC ---

This article describes the Apple Trackpad technology, implementation and benefits.

DISCUSSION ---

Key Points:
1) A conductive surface (such as a finger) is needed to move the cursor. Pointing devices such as pens, a Newton stylus or even a finger nail won't work. Humidity can also impair contact.
2) There is a slight learning curve. Users will have to adjust the control panel to their particular style.
3) There is a direct correspondence between the rectangular trackpad and rectangular screen, which allows even new users to quickly understand how to interact with and use the trackpad.
4) Solid state mechanism allows space to be allocated to larger, longer lasting batteries.
5) More reliable than a mouse or a trackball.

Description

The Apple trackpad is an innovative Apple Desktop Bus (ADB) pointing device that provides precise control over cursor movement. Based on user testing and feedback, Apple engineers have tuned the interface to make the trackpad a very efficient pointing device for interacting with the computer. In fact, user tests involving both the trackpad and Apple's own trackball have shown that the trackpad increases accuracy and efficiency by 20%. In the latest round of user testing, all participants preferred the trackpad over the trackball both initially and after an hour of continuous use.

Technology Overview

The technology works on a principal called coupling capacitance. As the user's finger moves over the surface, the trackpad evaluates the change in capacitance between two layers of measurement electrodes built into the surface of the trackpad. The electrodes are arranged in a checkerboard configuration, which creates a series of intersections, or couplings, where the capacitance is measured by the trackpad. The horizontal electrodes send out a test pattern signal which the vertical electrodes sense. As a finger approaches the trackpad

surface, its presence lowers the capacitance (coupling coefficient) at the closest electrode intersections and modifies the signal received by the sense electrodes. (The finger is able to effect the coupling capacitance because the human body is conductive. Other pointing devices like the Newton stylus, which are by nature nonconductive, will not effect a change in the coupling capacitance, and thus can not be used with the trackpad.)

By monitoring this change in capacitance, the trackpad is able to first locate and then compare the current location of low capacitance (where the finger is touching) to the previous location, and then moves the cursor accordingly. This cycle of sending out a test pattern, sensing the change in capacitance, and moving the cursor is constantly repeated. The high resolution of the trackpad (387 dots per inch in the horizontal and vertical directions) allows precise control over cursor movement down to the pixel level. The new Pad control panel offers the user a full range of acceleration to ensure precise control.

Implementation Issues

There is a learning curve associated with the first use of any input device. Our research has shown that the learning curve for the trackpad is the same as, or even smaller than that of, the trackball for first time users. Experienced trackball users have been able to achieve greater accuracy and efficiency with the trackpad in a very short period of time. In fact, user preference leans in favor of the trackpad. The trackpad translates finger movement into cursor movement seen on the screen, and the degree of motion is modified by what are called “acceleration curves.” Understanding how acceleration curve settings affect the control of the cursor is the major learning hurdle that new users need to overcome.

The faster a user's finger moves across the pad, the faster and farther the cursor will move across the display. If the finger moves quickly, the cursor will traverse the display completely. If the finger moves slowly, the cursor can be controlled quite precisely. In fact, just rocking the finger tip slightly on the pad gives pixel level accuracy! New trackpad users can experiment with the control settings in the Pad control panel to see which acceleration setting works best. The acceleration curve settings offered range from slow to fast. The higher the curve chosen, the farther the user will be able to traverse the screen with a shorter finger movement on the pad. The setting that is most preferred among users is the fourth setting up from the slowest setting. Once the users gain this intuitive understanding of how acceleration curves provide flexible and accurate control of the cursor, they immediately become more comfortable with the trackpad.

Benefits

There are many significant improvements and benefits afforded by going to the new trackpad as a pointing device. The first is a very important advancement in the user interface referred to as “direct interface.” Direct interface means that there is a direct correspondence between the rectangular trackpad and rectangular screen, which allows even new users to quickly understand how to interact with and use the trackpad. Second, as a solid state device, there are no moving parts, which means that it draws less power and is much less susceptible to breakage or even contamination. Third, because of its thinner

design and lighter weight, the trackpad allows Apple to allocate more space to other internal components like larger batteries, and so on. Finally, to ensure durability, the trackpad is covered by a special polymer “overcoat” that protects it from abrasion and spills. And since there are no moving parts, the trackpad is much more reliable than either a trackball or a mouse.

Support Information Services

Keywords: kpbook

==========

19960215 11:05:19.00
Tech Info Library Article Number: 15285