The UnMousePad - The Future of Touch Sensing

Ilya Rosenberg[*] Ken Perlin[†] Charles Hendee[‡] Alex Grau[§] Nadim Awad[¶]
New York University Media Research Lab

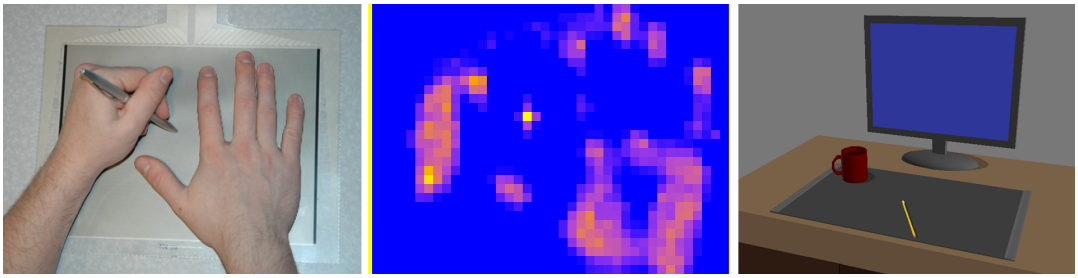

Figure 1: *Left: Writing/leaning on an UnMousePad and the captured force image. Right: Personal work space of the future.*

1 Introduction

Multi-touch input has been an active area of research for over two decades but has always suffered from the absence of an easily available high quality touch input device. For this reason, exciting user interfaces developed in the lab have appeared on CNN, but not on everyone's desk, computer screens, table-tops, walls and floors. What has been needed - and lacking - is a better mousetrap; an inexpensive, flexible and sensitive *touch imaging* technology.

The UnMousePad is that better mousetrap - a novel form of input sensor that enables inexpensive multi-touch, pressure acquisition at both small and large form-factors. It can accurately measure entire images of pressure with continuous bilinear interpolation, permitting both high-frame-rate and high quality imaging of spatially variant pressure upon a surface.

Though the use of force variable resistors as multiple points of contact input devices is not new, previous work in this area has focused mainly on arrays of discrete and independent sensors. The key difference between the UnMousePad and previous technologies is that it is based on Interpolating Force Sensitive Resistance (IFSR), which closely mimics the multi-resolution properties of human skin, in which the position of a touch can be detected at finer scale than the discrimination of multiple touches.

The development of the UnMousePad and other IFSR based sensors and an improved understanding of their electrical properties enhances the type and quality of information that may be obtained in situations where entire images of pressure need to be acquired in real-time or in situations where multiple points of pressure need to be continuously tracked.

2 Demonstration

For our demonstration, we plan to show how we envision ordinary people will use IFSR based sensors in their daily lives in the not too distant future. We plan to set up several demonstration areas with the following sensor form factors:

1. *The future of portable electronic devices:* A 2.5" x 3.5" sensor will be placed on the back of a portable electronic device having a small screen. The device will be operated by pressing on the back, keeping fingers from obscuring and leaving smudges on the screen.
2. *The future of electronic paper:* An 8.5" x 11" sensor will be integrated below the eInk display of a portable ebook reader. Users will be able to intuitively flip through pages and write on the electronic paper.
3. *The future personal work space:* A transparent 12" x 16" sensor will be placed over a 1/8" thick LCD display which will lay flat, having the appearance of an ink blotter. There will also be a large 30" display in front of the user with a web cam mounted on top and looking down at the user's hands in order to track their position. Software applications will demonstrate the power of this interface and its advantages over keyboards and mice.
4. *The future of play:* A circular 14" diameter hand-drum sensor will be mounted on a drum stage and covered with a soft rubber pad. Like a real drum, the drum will produce different timbres of sound depending on how it is hit, and users will be able to change the pitch of the drum by pressing down with one hand while hitting with the other.

For our demonstrations of some of the ways in which these devices can be used, we will present the following software applications:

1. Various visualization of pressure measured by the devices.
2. Tracking of fingers and pens; writing through a pad of paper.
3. Use as a traditional keyboard and mouse.
4. Six degree of freedom manipulation of virtual objects.
5. Painting with an overhead camera used to track hands and display their absolute position on the screen.
6. Sculpting of surfaces, spherical planet terrain, and clay.
7. Instruments including a piano, a synthesizer with continuous tones, FOF voice synthesis, a Theremin, and a hand-drum.
8. Animation of a water surface, faces, and virtual characters.

3 Conclusion

IFSR based sensor technology is inherently unobtrusive, inexpensive, and very durable. It has a very wide range of potential applications in many sectors of society, enabling multi-touch pressure imaging at a low cost in a wide variety of form factors. In our talk, demonstration and poster, we plan to show the technical aspects that underly the IFSR technology, and to inspire people to think about the myriad of novel form factors and exciting applications that are made possible by this revolutionary new technology.

[*]e-mail:ilya@cs.nyu.edu
[†]e-mail:perlin@cs.nyu.edu
[‡]e-mail:chendee@gmail.com
[§]e-mail:alexgrau@gmail.com
[¶]nadim.awad@gmail.com

SIGGRAPH 2009, New Orleans, Louisiana, August 3–7, 2009.
ISBN 978-1-60558-726-4/09/0008