MICROSOFT SURFACE:

MULTI-TOUCH TECHNOLOGY

A White Paper

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What are multi-touch surfaces?

Multi-touch surfaces allow for a device to recognize two or more simultaneous touches by more than one user. Some have the ability to recognize objects by distinguishing between the differences in pressure and temperature of what is placed on the surface. Depending on the size and applications installed in the surface, two or more people can be doing different or independent applications on the device. Multi-touch computing is the direct manipulation of virtual objects, pages, and images allowing you to swipe, pinch, grab, rotate, type, and command them eliminating the need for a keyboard and a mouse. Everything can be done with our finger tips.

Microsoft Surface

http://www.microsoft.com/surface/index.html

Defined:

Microsoft Surface is an interactive table top that can do everything a network computer can do plus more without using a keyboard or a mouse. There are four key features: direct interaction, multi-touch ability, multi-user ability, and object recognition. Direct interaction allows you to touch or grab digital information with your hands and use natural gestures to open, grasp, and command virtual objects, pages and images. The multi-touch feature enables the Surface to recognize many points of contact simultaneously so you can enlarge an image by touching the opposite corners and dragging them outwards. Along with the multi-touch feature, the shape and design of the Surface allows for multi-users at once, therefore, the user sitting across from you can be doing something completely different or independent of you. The last key feature, object recognition, enables the system to identify physical objects just by setting them on the Surface and to respond by displaying the appropriate software related to that item. Currently, Microsoft Surface is being marketed and sold directly to large scale leisure, entertainment and retail companies, such as AT&T in various cities, Rio in Las Vegas, and Sheraton Hotels in various cities. The image below of a part of the order form shows the pricing information (Figure A).

Other multi-touch technologies exist such as Jeff Han's multi-touch wall which has demonstrated similar abilities as the Surface but is larger in size and costs around $100,000 and the SMART multi-touch tables, which have been referred to as "Surface Jr," coming available next year for somewhere between $7,000 and $8,000. Even though the SMART multi-touch tables are very similar to the Microsoft Surface, two differences are that they are not quite as responsive and have a kid-proof plastic screen.

Additional Pricing Information:

Microsoft Surface

Microsoft Surface Order Form

For Professional Developers Conference, Valid from October 28, 2008 until November 15, 2008

Pursuant to the attached Terms, submit this Order Form to order Surface Commercial Hardware Units, Surface Developer Hardware Units, additional SDK Software, and/or Services. All orders are subject to approval of credit. Shipment and/or services will be subject to availability of units and/or service support. This Order Form and the Terms are your Agreement with Microsoft for this Microsoft Surface order.

A. Commercial Hardware. Each commercial hardware unit includes one Surface Software license.

Product	SKU	List Price	Quantity	Total ($)
Surface Commercial Hardware Unit – Metal	JUH-00017	$12,500	0	$0.00
Surface Commercial Hardware Unit – Black	JUH-00018	$12,500	0	$0.00
Surface Commercial Hardware Unit – White	JUH-00019	$12,500	0	$0.00
		Subtotal	0	$0.00

B. Developer Hardware & Software. Each developer hardware unit includes one Surface Software license and five SDK Software licenses.

Product	SKU	PDC Discounted Price	Quantity	Total ($)
Surface Developer Hardware Unit – Metal	JUI-00018	$13,500	0	$0.00
Surface Developer Hardware Unit – Black	JUI-00019	$13,500	0	$0.00
		Subtotal	0	$0.00

C. Services. Services listed below are available for purchase at time of order. When a service is selected for commercial hardware units, it will apply to all commercial hardware units ordered; the same applies to services selected for developer hardware units. Installation service is required for commercial hardware units and is automatically added to the total order amount. Standard shipping applies to all units ordered unless Expedited Shipping is selected. Descriptions and terms governing Surface Care services are in separate Microsoft documents.

Service	SKU	List Price	Commercial #	Developer #	Total ($)
Surface Care Installation Service	JUJ-00001	$1,500	☐	☐	$0.00
Surface Care Maintenance Service	JUJ-00002	$1,500	☐	☐	$0.00
1-Year Extended Warranty	JUJ-00004	$1,500	☐	☐	$0.00
Shipping (per unit) 3-5 days	JUJ-00005	$240	◉		
Expedited Shipping (per unit) 1-2 days	JUJ-00006	$530	○		$0.00
				Subtotal	$0.00

Figure A: Pricing Information

Application:

The following is an example of a possible application using Microsoft Surface:

1) On the left you have your device which has stored your information.
2) On the right you have your friend's device which has stored his/her information.
3) In the center it's showing how you can pull the information needed from each device and compile it to complete the final project.

Technical Aspects/Features:
These all have the same basic framework using cameras to sense objects, hand gestures, and touch. The user input is then processed and displayed on the surface using rear projection. The following is a diagram of the Microsoft Surface (Figure B) and an explanation of the parts.

1) Screen: The Surface has an acrylic tabletop which a diffuser makes capable of processing multiple inputs from multiple users. Objects can also be recognized by their shapes or reading coded tags.
2) Infrared: Infrared light is projected onto the underside of the diffuser. Objects or fingers are visible through the diffuser by series of infrared-sensitive cameras which are positioned underneath the surface of the tabletop.
3) CPU – This is similar to a regular desktop. The underlying operating system is a modified version of Microsoft Vista.
4) Projector – The Surface uses the same DLP light engine in many rear-projection tvs.

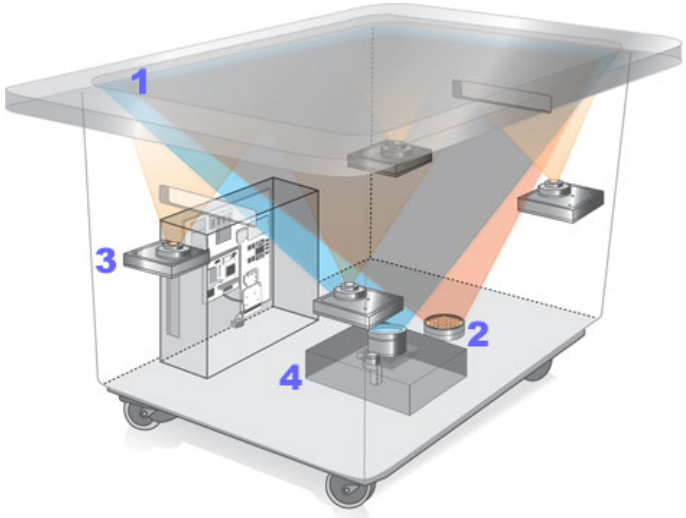
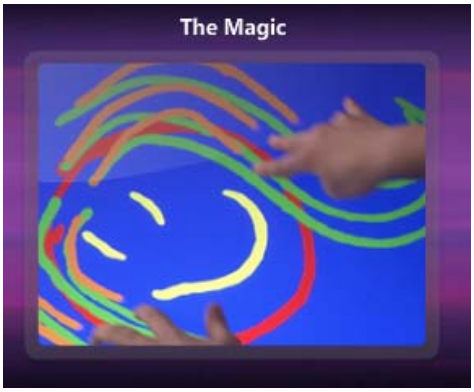


Figure B: Surface diagram

Additional images and videos:
http://www.microsoft.com/surface/videos.html#gid=demos&vid=starwoodlaunch



Education Implications:

- Today's computers allow you to have multiple applications in multiple windows but they probably only have one keyboard and mouse which means only one person can operate at a time. These Surfaces engage the senses, improve collaboration, and empower the students by having everything available to them at their finger tips.
- Interactive Classrooms: The multi-touch surface computers will encourage the students to interact with content and each other promoting group work and team building skills.
- Students would have custom built hardware where they can create their assignments and teachers may be able to see it instantly and help the students.
- Students sitting around the table may open a file, push it across, drag it, modify it, let another student add or delete information and then save the document.
- In a photography class, the students could share their images instantly.
- In an art class, one student could be painting with a paint brush while another is drawing with her finger. Both the paint brush and the finger would be recognized.
- In Business classes, specifically accounting, having access to a computer right at your finger tips will help the students learn faster and comprehend on a higher level I believe. It's a lot easier to follow along on an Excel spreadsheet when you can highlight the cell and see for yourself what the formula is or where that amount came from. Allowing students the ability to actively participate while teaching them about constructing a balance sheet will make it easier for the students to not only comprehend the material but also retain the material in my opinion.
- In a geography class each student could find a specific location and the maps could be displayed instantly.
- Teachers would not have to worry about finding space in a computer lab in order for the students to create projects or conduct research.
- Students could share podcasts or other information related to a certain project that they have saved to their flash drive just by laying the device on the surface.

Relative NETS Standards:

The following standard is addressed with the use of multi-touch technology:

Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.

Students:

a. Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
c. Develop cultural understanding and global awareness by engaging with learners of other cultures.
d. Contribute to project teams to produce original works or solve problems.

The design of the multi-touch technologies promotes group work and team building activities. It allows four students to sit at it comfortably with one on each side and enables the students to work collaboratively on a project or they can work individually each on a different piece of the project while using the same Surface.

Implementation Factors:

Microsoft Surface is a table-like structure with a 30-inch display screen centered on the top or "surface" of the table. The software runs on Windows Vista and has many type of connection capabilities depending on your needs, such as a regular network card (wired Ethernet 10/100), wireless network card (wireless 802.11 b/g), and Bluetooth card connectivity (used for headphone, printer, etc. connections). As far as technology support, each school would need to have a full time network administrator on site along with team of additional IT support. The increase in number of users would need to be addressed prior to implementing these into all classrooms. The ideal situation would be to have "dumb terminals", i.e. each desk would be a Surface minus the CPU. The information would not be stored locally. The teacher would have the main Surface and the students' smaller Surfaces would link to the teacher's. The student's information and data would be stored on the school's central server so that as they move from class to class they can still access their information. For additional software capabilities the school would need to purchase a server license so that any computer connected to that server would have access to the software.

User Instructions:

I recently had the privilege of being able to use one the Surface tables in an AT&T store in Washington, DC. The applications were specific to AT&T but I was able to set a cell phone on

the surface and watch as the data appeared on the screen. I could pull opposite corners of a picture to enlarge it. I brought up the service area map and then was able to go to South Carolina and magnify it all the way down until I could see my street. I was able to manipulate the data that was extracted all with the touch of my fingertips. I was able to do this while another customer was standing on the other side processing their own research of the AT&T phones.

With the scenario I would like to see evolve, the instructions would be pretty simple. There would be a central Surface in each classroom operated by the teacher. Each student's desk top would be replaced by a multi-touch surface which would be linked to the teacher's Surface. Each student would have a username and password and their data or work would be stored on a central server so that they could access it from any Surface in the school. Once they log in at their desk, they would continue as if it were a regular computer and follow along as the teacher goes through the daily lessons.

Additional Information:
Microsoft Surface: http://www.microsoft.com/surface/index.html

Advantages of Multi-touch Technology:

- The administration of a classroom can be improved by reducing the amount of time a teacher spends fulfilling paperwork requirements alone, such as test taking and scoring. The tests could be included in each student's desktop and automatically recorded and scored.
- The teacher's desktop could have the ability to look at each student's desktop from their desk and take control if necessary. This can be used to help a student having trouble or to verify that the student is staying on task.
- Also, teachers would have the ability to send presentations to any or all desktops eliminating the need for print outs and copies.
- A chat system like IM could be set up so that the teacher could send a private note to a student during a class exercise without bringing attention to the student whether it is positive or negative.
- If a problem occurred on one Surface, that student could move to another student's desk and work along with them until theirs was fixed.
- By engaging the students and combining both the audio and visual aspects in every lesson plan, we have a better chance of reaching every student and increasing the percentage of information retained.
- Students will be able to work in groups at one desktop Surface. This would make the construction of projects easier. Also, students will be able to work on class assignments together or help each other and sometimes students are able to learn and understand better when the information is delivered or reiterated from their peers in a more creative fashion.

Disadvantages of Multi-touch Technology:

- The technology is currently expensive and just beginning to gain some recognition out in the marketplace.
- If these tables have the ability to have 4 students to each one, privacy becomes an issue which will need to be addressed especially during test taking times. Also, you wouldn't want one student to be able to reach over and delete another student's work. The issue of personal space and boundaries would need to be addressed.
- Another disadvantage would be that technology is unreliable and if a problem occurred with an application class would be disrupted even if only for a short period of time.

The Future:

What I would like to see happen is each student's desk top be replaced by a multi-touch technology similar to the Microsoft Surface. Each classroom and teacher would have their Surface applications customized to fit their specific curriculum. These devices offer various ways of visualizing the information in order to improve understanding which enables our students to excel. I feel we need to find ways to keep up with the rapidly growing world of technology and integrate it into our classrooms or our students are going to surpass us and figure out ways to do things better and faster at home on their own personal computer. With Microsoft Surface the opportunities are endless with the ability to create custom applications for specific businesses or educational purposes or building packaged applications for use across a range of industries or schools.

Resources:

http://www.multitouchtechnology.com/

http://www.microsoft.com/surface/index.html

http://www2.smarttech.com/st/en-US/Products/SMART+Table/

http://www.engadget.com/2008/10/23/kids-on-with-the-smart-table/

http://blogs.msdn.com/surface/archive/2008/11/04/surface-your-end-users-and-you.aspx

http://download.microsoft.com/download/d/9/1/d91f9fb0-c42c-47a5-8c08-6bd80587c002/MSSurfaceOrderForm-PDC.pdf