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**MICROSOFT SURFACE COMPUTING**

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**CONTENT:-**

**1) INTRODUCTION**

**2) WHAT IS SURFACE COMPUTING ?**

**3) HISTORY OF SURFACE COMPUTING**

**a) HARDWSARE DESIGN**

**b) FROM PROTOTYPE TO PRODUCT**

**4) KEY ATTRIBUTES OF SURFACE COMPUTING**

**5) TECHNOLOGY BEHIND SURFACE COMPUTING**

**6) MICROSOFT SURFACE OVER VIEW**

**a) THE HARDWARE**

**b) SYSTEM SOFTWARE**

**7) FETURES**

**8) PERCEPTIVE PIXEL**

**9) ADVANTAGE**

**10) DISADVANTAGES**

**11) APPLICATION OF SURFACE COMPUTING**

**a) WATER**

**b) VIDEO PUZZLE**

**c) PHOTOS**

**d) CASINO**

**12) SURFACE COMPUTING IN FUTURE**

**13) CONCLUSION**

**14) REFERENCE**

## 1.INTRODUCTION:

Over the past couple of years, a new class of interactive device has begun to emerge, what can best be described as ―surface computing‖.An examples of illustrated in this report. That is, Surface Table top Perceptive Pixel. With today’s camera and signal-processing capability, reliable responsive and accurate multi-touch capabilities can be achieved. The multitouch pioneer and his company, Perceptive Pixel , have devoted the better part of two years to building an entirely new multitouch framework from the ground up. Instead of simply mapping multitouch technology to familiar interfaces and devices, Han's goal is far more sweeping: To use the technology as a foundation for an entirely new operating system. Because they are new to most, the tendency in seeing these systems is to assume that they are all more-or-less alike. Well, in a way that is true. But on the other hand, that is perhaps no more so than to say that all ICs are more-or-less alike, since they are black plastic things with feet like centipedes which contain a bunch of transistors and other stuff. In short, the more that you know, the more you can differentiate. But even looking at the two systems in the photo, there is evidence of really significant difference. The really significant difference is that one is vertical and the other is horizontal.

Why is this significant? Well, this is one of those questions perhaps best answered by a child in kindergarten. They will tell you that if you put a glass of water on the vertical one, it will fall to the floor, leading to

about of sitting in the corner. On the other hand, it is perfectly safe to put things on a table. They will stay there.

**2. WHAT IS SURFACE COMPUTING?**

Surface computing is a new way of **working with computers** that moves **beyond the traditional mouse-and-keyboard experience.** It is a natural user interface that allows people to interact with digital content the same way they have interacted with everyday items such as photos, paintbrushes and music their entire life: with their hands, with gestures and by putting real-world objects on the surface. Surface computing opens up a whole new category of products for users to interact with. Surface computing is a **completely intuitive and liberating way to interact with digital content**. It blurs the lines between the physical and virtual worlds. By using your hands or placing other unique everyday objects on the surface – such as an item you’re going to purchase at a retail store or a paint brush – you can interact with, share and collaborate like you’ve never done before. Imagine you’re out at a restaurant with friends and you each place your beverage on the table – and all kinds of information appears by your glass, such as wine pairings with a restaurant’s menu. Then, with the flick of your finger, you order dessert and split the bill. We really see this as broadening content

opportunities and delivery systems.

Surface computing is a powerful movement. In fact, it’s as significant as the move from DOS [Disk Operating System] to GUI [Graphic User Interface]. Our research shows that many people are intimidated and isolated by today’s technology. Many features available in mobile phones, PCs and other electronic devices like digital cameras aren’t even used because the technology is intimidating. Surface computing breaks down those traditional barriers to technology so that people can interact with all kinds of digital content in a more intuitive, engaging and efficient manner. It’s about technology adapting to the user, rather than the user adapting to the technology.

**3. HISTORY OF SURFACE COMPUTING:**

In 2001, **Stevie Bathiche** of Microsoft Hardware and **Andy Wilson** of Microsoft Research began working together on various projects that took advantage of their complementary expertise in the areas of hardware and software. Although there were related efforts happening in academia, Bathiche and Wilson saw the need for a product where the interaction was richer and more intuitive, and at the same time practical for everyone to use. This conversation was the beginning of an idea that would later result in the development of Surface, and over the course of the following year, various people at Microsoft involved in developing new product concepts, including the gaming-specific PlayTable, continued to think through the possibilities and feasibility of the project. Then in October 2001 a virtual team was formed to fully pursue bringing the idea to the next stage of development; Bathiche and Wilson were key members of the team. In early 2003, the team presented the idea to Bill Gates, Microsoft chairman, in a group review. Gates instantly liked the idea and encouraged the team to continue to develop their thinking. The virtual team expanded, and within a month, through constant discussion and brainstorming, the first humble prototype was born and nicknamed T1.

The model was based on an IKEA table with a hole cut in the top and a sheet of architect vellum used as a diffuser. The evolution of Surface had begun. A variety of early applications were also built, including pinball, a photo browser and a video puzzle. As more applications were developed, the team saw the value of the surface computer beyond simply gaming and began to favor those applications that took advantage of the unique ability of Surface to recognize physical objects placed on the table. The team was also beginning to realize that surface computing could be applied to a number of different embodiments and form factors. Over the next year, the team grew significantly, including the addition of Nigel Keam, initially software development lead and later architect for Surface, who was part of the development team eventually tasked with taking the product from prototype to a shipping product.

Surface prototypes, functionality and applications were continually refined. More than 85 early prototypes were built for use by software developers, hardware developers and user researchers. The team explored various tag formats of all shapes and sizes before landing on the domino tag (used today) which is an 8-bit, three-quarter-inch-square tag that is optimal thanks to its small size. At the same time, the original plan of using a single camera in the vision system was proving to be unreliable. After exploring a variety of options, including camera placement and different camera lens sizes, it was decided that Surface would use five cameras that would more accurately detect natural movements and gestures from the surface.

**3.1 Hardwar Design:**

The “Tub” model:

By late 2004, the software development platform of Surface was well-established and attention turned to the form factor. A number of different experimental prototypes were built including ―the tub‖ model, which was encased in a rounded plastic shell, a desk-height model with a square top and cloth-covered sides, and even a bar-height model that could be used while standing. After extensive testing and user research, the final hardware design (seen today) was finalized in 2005. Also in 2005, Wilson and Bathiche introduced the concept of surface computing in a paper for Gates’ twice-yearly ―Think Week, a time Gates takes to evaluate new ideas and technologies for the company.

**3.2 From Prototype To product**

“T1 Prototype”

The next phase of the development of Surface focused on continuing the journey from concept to product. Although much of what would later ship as Surface was determined, there was significant work to be done to develop a market-ready product that could be scaled to mass production. In early 2006, Pete Thompson joined the group as general manager, tasked with driving end-to-end business and growing development and marketing. Under his leadership, the group has grown to more than 100 employees. Today Surface has become the market-ready product once only envisioned by the group, **a 30-inch display in a table**- like form factor that’s easy for individuals or small groups to use collaboratively. The sleek, translucent surface lets people engage with Surface using touch, natural hand gestures and physical objects placed on the surface. Years in the making, Microsoft Surface is now poised to transform the way people shop, dine, entertain and live. This is a radically different user-interface experience than anything and it’s really a testament to the innovation that comes from marrying brilliance and creativity.

**4. KEY ATTRIBUTES OF SURFACE COMPUTING:**

Surface computing features four key attributes:

• **Direct interaction**. Users can actually ―grab‖ digital information with their hands and interact with content through touch and gesture, without the use of a mouse or keyboard.

• **Multitouch contact**. Surface computing recognizes many points of contact simultaneously, not just from one finger as with a typical touch screen, but up to dozens and dozens of items at once.

• **Multi-user experience.** The horizontal form factor makes it easy for several people to -gather around surface computers together, providing a collaborative, face to face computing experience.

• **Object recognition**. Users can place physical objects on the surface to trigger different types of digital responses, including the transfer of digital content.

**5. TECHNOLOGY BEHIND SURFACE COMPUTING:**

Microsoft Surface uses **cameras to sense objects**, hand gestures and touch. This user input is then processed and displayed using rear projection. Specifically: Microsoft Surface uses a rear projection system which displays an image onto the underside of a thin diffuser. Objects such as fingers are visible through the diffuser by series of infrared–sensitive cameras, positioned underneath the display. An image processing system processes the camera images to detect fingers, custom tags and other objects such as paint brushes when touching the display. The objects recognized with this system are reported to applications running in the computer so that they can react to object shapes, 2D tags, movement and touch.

One of the key components of surface computing is a **"multitouch"** screen. It is an idea that has been floating around the research community since the 1980s and is swiftly becoming a hip new product interface — Apple's new iPhone has multitouch scrolling and picture manipulation. Multitouch devices accept input from multiple fingers and multiple users simultaneously, allowing for complex gestures, including grabbing, stretching, swiveling and sliding virtual objects across the table. And the Surface has the added advantage of a horizontal screen, so several people can gather around and use it together. Its interface is the exact opposite of the personal computer: cooperative, hands- on, and designed for public spaces.

**6. MICROSOFT SURFACE OVERVIEW:**

Microsoft Surface turns an ordinary tabletop into a vibrant, interactive computing experience. The product provides effortless interaction with digital content through natural gestures, touch and physical objects. In Essence, it’s a surface that comes to life for exploring, learning, sharing, creating, buying and much more. Currently available in select in restaurants, hotels, retail establishments and public entertainment venues, this experience will transform the way people shop, dine, entertain and live. - - Surface is a 30 inch display in a table like form factor that’s easy for individuals or small groups to interact with in a way that feels familiar, just like in the real world. Surface can simultaneously recognize dozens and dozens of movements such as touch, gestures and actual unique objects that have identification tags similar to bar codes. Surface computing breaks down traditional barriers between people and technology, changing the way people interact with all kinds of everyday content, from photos to maps to menus. The intuitive user interface works without a traditional mouse or keyboard, allowing people to interact with content and information by using their hands and natural movements. Users are able to access information either on their own or collaboratively with their friends and families, unlike any experience available today.

**6.1 The Hardware**

Essentially, Microsoft Surface is a computer embedded in a medium-sized table, with a large, flat display on top that is touch-sensitive. The software reacts to the touch of any object, including human fingers, and can track the presence and movement of many different objects at the same time. In addition to sensing touch, the Microsoft Surface unit can detect objects that are labeled with small "domino" stickers, and in the future, it will identify devices via radio-frequency identification (RFID) tags. The demonstration unit I used was housed in an attractive glass table about three feet high, with a solid base that hides a fairly standard computer equipped with an Intel Core 2 Duo processor, an AMI BIOS, 2 GB of RAM, and Windows Vista. The team lead would not divulge which graphics card was inside, but they said that it was a moderately- powerful graphics card from either AMD/ATI or NVIDIA.

(1) **Screen:** A diffuser turns the Surface's acrylic tabletop into a large horizontal "multitouch" screen, capable of processing multiple inputs from multiple users. The Surface can also recognize objects by their shapes or by reading coded "domino" tags.

(2) **Infrared**: Surface's "machine vision" operates in the near-infrared spectrum, using an **850-nanometer-wavelength** LED light source aimed at the screen. When objects touch the tabletop, the light reflects back and is picked up by multiple infrared cameras with a net resolution of 1280 x 960.

(3) **CPU**: Surface uses many of the same components found in everyday desktop computers — a Core 2 Duo processor, 2GB of RAM and a 256MB graphics card. Wireless communication with devices on the surface is handled using WiFi and Bluetooth antennas (future versions may incorporate RFID or Near Field Co mmunications). The underlying operating system is a modified version of Microsoft Vista.

(4) **Projector:** Microsoft's Surface uses the same DLP light engine found in many rear- projection HDTVs. The footprint of the visible light screen, **at 1024 x 768 pixels**, is actually **smaller than the invisible overlapping** infrared projection to allow for better recognition at the edges of the screen. The display screen is a 4:3 rear-projected DLP display measuring 30 inches diagonally. The screen resolution is a relatively modest 1024x768, but the touch detection system had an effective resolution of 1280x960. Unlike the screen resolution, which for the time being is constant, the touch resolution varies according to the size of the screen used—it is designed to work at a resolution of 48 dots per inch. The top layer also works as a diffuser, making the display clearly visible at any angle. Unlike most touch screens, Surface does not use heat or pressure sensors to indicate when someone has touched the screen.

**6**.**2 System Software**  Microsoft Surface works much like another Microsoft product, Media Center, in that the main application runs on top of Windows and takes over the whole screen. Like Media Center, it is designed to be difficult to exit the application without using a mouse or keyboard. I asked if the Surface team considered allowing the user to drop into Windows mode while retaining the touch functionality, but they felt that the product worked better if it stayed in this mode. The various demonstration programs are accessed from a main menu, which scrolls left and right in an endless loop. The user moves the selection by swiping back and forth and selects an application with a single tap. This works reasonably well and feels quite natural. When an application is selected, a swirly purple ring appears in the center of the screen to indicate that the program is loading. There were eight different programs available: Water, Video Puzzle, Paint, Music, Photos, Casino, a T-Mobile demonstration app, and Dining. Much of the software was written using Microsoft's WPF (Windows Presentation Foundation), though the XNA development toolkit, a framework originally created for writing PC and Xbox 360 games, is also supported. XNA allows programmers to use managed code written in C# to manipulate various DirectX features; managed code frees the programmer from worrying about handling memory, allocating and discarding memory automatically. This approaches allowed Microsoft and its partners to write impressive-looking demonstration programs for Surface more quickly than would otherwise be possible.

**7. FEATURES:**

**Multi-touch display**: The Microsoft Surface display is capable of multi-touch interaction, recognizing dozens and dozens of touches simultaneously, including fingers, hands, gestures and objects. Perceptive Pixel’s touch screens work via frustrated total internal reflection.

**Technology:** The acrylic surface has infrared LEDs on the edges. When undisturbed, the light passes along predictable paths, a process known as total internal reflection. When one or more fingers touch the surface, the light diffuses at the contact points, changing the internal-reflection pathways. A camera below the surface captures the diffusion and sends the information to image-processing software, which translates it into a command. Multitouch technology has been around since early research at the University of Toronto in 1982. With multitouch devices, one or more users activate advanced functions by touching a screen in more than on place at the same time. For example, a person could expand or shrink images by pinching the edges of the display window with the thumb and forefinger of one hand, explained Microsoft principal researcher Bill Buxton.

Users could also, while in contact with a point on a map, touch other controls to make the system display information, such as nearby restaurants, about the area surrounding the indicated location. This is accomplished much as it has been in PCs for years. For example, desktop users can press the Alt and Tab keys at the same time to toggle between open windows. The OS translates the simultaneous keystrokes into a single command. Industry observers say tabletop computers are likely to become a popular multitouch- screen implementation. Because multiple users at different positions will work with tabletop systems, the computers must be able to display material in different parts of the screen and move controls around to keep them from blocking reoriented content.

The systems can determine users’ locations based on the positions from which they input commands or data. The computers then orient their displays toward the tabletop edge nearest to the user. Vendors are beginning to release commercial multitouch systems. For example, Mitsubishi Electric Research Laboratories’ Diamond Touch table, which includes adeveloper’s kit, can be used for small-group collaboration **Horizontal orientation:** The 30-inch display in a table-sized form factor allows users to share, explore and create experiences together, enabling a truly collaborative computing experience.

**Dimensions:** Microsoft Surface is 22 inches high, 21 inches deep and 42 inches wide. Materials: The Microsoft Surface tabletop is acrylic, and its interior frame is powder-coated steel.

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**Surface Diagram**

**8. PERCEPTIVE PIXEL:**

Jeff Han demos one of Perceptive Pixel’s multitouch devices by calling up various Minority Report photos from the Web on his virtual keyboard. With a flick of his finger, he severs Tom Cruise's head from his body and sets it frenetically bobbing across the screen.

Computer scientists see technologies such as surface computing and multitouch as the key to a new era of ubiquitous computing, where processing power is embedded in almost every object and everything is interactive. Last year, New York University professor Jeff Han launched a company called Perceptive Pixel, which builds six-figure- plus custom multitouch drafting tables and enormous interactive wall displays for large corporations and military situation rooms. "I firmly believe that in the near future, we will have wallpaper displays in every hallway, in every desk. Every surface will be a point of interaction with a computer," Han says, "and for that to happen, we really need interfaces like this."

The display’s surface is a six-millimeter-thick piece of clear acrylic, with infrared LEDs on the edges. Left undisturbed, the light passes along predictable paths within the acrylic, a process known as total internal reflection. When objects such as fingers touch the surface, the light diffuses at the contact point, causing the acrylic’s internal-reflection pathways to change. A camera below the surface captures the diffusion and sends the information to image-processing software, which can read multiple touches simultaneously and translate them into a command. The system sends information about screen touches to applications via the lightweight Open Sound Control protocol, utilized for network-based communication between computers and multimedia devices, and User Datagram Protocol data transport technology. The applications then take the appropriate actions. Perceptive Pixel, which has built a prototype that measures 36 \_ 27 inches, is still working on applications for its displays, Han noted. They could be used for collaborative work on design-related and other projects, perhaps in place of interactive whiteboards, he said. Short-term success for a technology can be measured by how much attention a product gathers when it is new. Long-term success is measured by how effectively that product disappears into the everyday routine of life. Surface computing has enormous potential to do both — it is a splashy new computer interface, surrounded by hype, but it is also, quite literally, furniture. It is a technology in its infancy, where even the engineers behind it can't predict its full impact; but the possibilities are everywhere, underhand and underfoot — on every surface imaginable.

**9. ADVANTAGES :**

1. 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.

2. 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.

3. Also, teachers would have the ability to send presentations to any or all desktops eliminating the need for print outs and copies.

4. 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.

5. 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.

**10. DISADVANTAGES :**

1. The technology is currently expensive and just beginning to gain some recognition out in the marketplace.

2. 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.

3. 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.

**11. APPLICATIONS OF SURFACE COMPUTING:**

**1. Water**

Water is used as an "attract mode" for the Surface desktop, and it is certainly attractive. The default background picture is an image of smooth pebbles that appear to sit beneath a thin layer of rippling water. By itself, the water moves as if it were being disturbed by a light breeze, but it is when you touch the screen that it becomes more interesting than just another screensaver. Tapping anywhere on the surface causes larger ripples to spread out from the point of contact. Many people can tap at the same time, making an effect similar to a rainstorm. But by far the most fun is when you sweep your whole hand across and cause waves to bounce back and forth.

**2 Video Puzzle**

Video Puzzle showcases the power of the little identification tags mentioned above. The tags consist of a pattern of variously-sized dots; Keam mentioned that the dots currently represent an 8-bit code (256 permutations) but that 128-bit tags were in the works. The neat thing about the tags is that they can be very nearly transparent and the system will still pick them up. Not only can the tags transmit numerical information, but the geometrical arrangement of the dots means that Surface can also tell, to a high degree of accuracy, how much the tag (and therefore the object) has rotated.

**3 Photos**

Sharing photos is a much more unrestricted activity, thanks to the fact that the consumer is also the creator of the content, and the photo album application reflected this freedom. By simply placing a Bluetooth-equipped digital camera on the tabletop, Surface was able to import the photos and place them in a pile on the screen, which Bolger verified by taking a picture of Cindy, my Microsoft PR contact who was sitting in the next chair. Most of the other photos were pictures of Microsoft employees' children; Bolger joked that only the cutest kids were allowed to be put in the demonstration. Photos are arranged into albums that look like piles. Tapping the pile once spreads it around the screen and from there you can drag, rotate, and resize the images to your heart’s content. Since Surface can detect many touches at the same time, multiple people can sort and resize pictures, which could potentially turn a tedious job into a fun family affair. The program can also apparently sort photos into stacks by using metadata tags,

although I did not see this feature demonstrated. Not only pictures but full-motion videos can be viewed in this way; tapping the video once starts the playback, and it can be smoothly resized and rotated while it plays.

**4. Casino**

The Casino application was developed in cooperation with Harrah's of Las Vegas and is a good example of how Surface can be used in a hospitality environment. The background image is a giant map of the hotel and casino, with all the attractions marked for further inspection. Hotel customers can place their card anywhere on the screen and reserve tickets to any of these shows. The background map can be easily scrolled with a brush of the hand, and zoomed in and out by performing the two-finger pinch.

**12. SURFACE COMPUTING - IN FUTURE:**

Although surface computing is a new experience for consumers, over time. Microsoft believes there will be a whole range of surface computing devices and the technology will become pervasive in people’s lives in a variety of environments. As form factors continue to evolve, surface computing will be in any number of environments— schools, businesses, homes — and in any number of form factors — part of the countertop, the wall or the refrigerator.

**13. CONCLUSIONS:**

Some people will look at Surface and claim that it does nothing that hasn't been tried before: computers with touch screens have been around for years and have already found niches in ATMs, ticket ordering machines, and restaurant point-of-sale devices. This view largely misses the point of the product. Like most projects, Surface takes existing technology and presents it in a new way. It isn't simply a touch screen, but more of a touch-grab-move-slide-resize-and-place-objects-on-top-of-screen, and this opens up new possibilities that weren't there before. Playing with the unit felt a bit like being in the movie Minority Report (in a good way), but it also felt like a more natural and enjoyable method of doing certain computing tasks. Sharing and looking at family photos, for example, is more fun on Surface than on any other device. Many people who viewed the early Xerox PARC demonstrations of the GUI came out of that experience knowing that every computer would work that way someday, and they were right. More importantly, computers running Surface-like software will end up in places that never had computers before, and the potential applications are exciting.

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