1. INTRODUCTION

Surface computing is the term for the use of a specialized computer GUI in which traditional GUI elements are replaced by intuitive, everyday objects. Instead of a keyboard and mouse, the user interacts directly with a touch-sensitive screen. It is a natural user interface.

Surface computer was created by Microsoft with surface (code named Milan). The Surface is a horizontal display on a table-like form. A surface computer is a computer that interacts with the user through the surface of an ordinary object, rather than through a monitor and keyboard.

A surface computer is able to recognize physical objects from a paintbrush to a cell phone and allows hands-on, direct control of content such as photos, music and maps. Surface turns an ordinary tabletop into a dynamic surface that provides interaction with all forms of digital content through natural gestures, touch and physical objects.
2. HISTORY

An Idea Inspired by Cross-Division Collaboration

Microsoft Research began working together on various projects that took advantage of their complementary expertise in the areas of hardware and software. In one of their regular brainstorm sessions, they started talking about an idea for an interactive table that could understand the manipulation of physical pieces. 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.

Humble Beginnings on a Table

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.

One of the key attributes of Surface is object recognition and the ability of objects placed on the surface to trigger different types of digital responses, including the transfer of digital content. This feature went through numerous rounds of testing and refining. 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.

**Hardware Design**

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.
From Prototype to Product

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. “So much work goes into turning a prototype into a product that can handle the strain and stress of everyday use,” Keam said. “For instance, when we developed the T1 prototype, it couldn’t be moved without having to recalibrate it. Now, obviously the product can easily be moved. To get Surface to where it is today, the code had to be rewritten from the ground up.”

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.

“Seeing Surface grow from a small germ of an idea to a working prototype and then to a full-fl edged market-ready product has been an amazing journey,” Wilson said. “This is a radically different user-interface experience than anything Microsoft has done before, and it’s really a testament to the innovation that comes from marrying brilliance and creativity.”
Fig: 2.1 T1 Prototype (2003)

Fig: 2.2 Tub Prototype (2005)
fig: 2.3 Surface Computer (2007)

3. WHAT MAKES IT UNIQUE?
What makes it Unique?

Direct Interaction:

Multi-Touch:

Multi-User

Object Recognition:

Fig: 3.1 Show the Implication of Uniqueness

Four Key Attributes

Direct Interaction
Direct interaction means that, we can interact with the Surface by using our fingers. No other input device is needed to give input. This provides a natural interface effect.

Fig: 3.2 Direct Interaction

*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.

*Fig: 3.3 Multi touch*

*Multi-touch 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.

**Object recognition**

Users can place physical objects on the surface to trigger different types of digital responses, including the transfer of digital content. Object recognition is done in the surface by using special bar codes called Domino tags.
4. Technology Behind Surface Computing

The technology allows non-digital objects to be used as input devices. This is made possible by the fact that, in using cameras for input, the system does not rely on restrictive properties required of conventional touch screen or touchpad devices such as the capacitance, electrical resistance, or temperature etc.

The computer's "vision" is created by a near-infrared, 850-nanometer-wavelength LED light source aimed at the surface.

When an object touches the tabletop, the light is reflected to multiple infrared cameras allowing it to sense, and react to items touching the tabletop.

Microsoft Surface uses cameras to sense objects, hand gestures and touch. This user input is then processed and displayed using rear projection.

Microsoft Surface uses a rear projection system which displays an image onto the underside of a thin diffuser. An image processing system processes the camera images to detect fingers, custom tags and other objects such as paint brushes etc 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.
5. What is Surface Computer?

Surface Computer is a touch-based graphical user interface. Using specialized hardware designed to replace the keyboard and mouse used in typical computing applications, Surface enables a level of interaction previously unattainable with conventional hardware. The system is composed of a horizontal touchscreen under a coffee table-like surface, with cameras mounted below to detect user interaction activities. All interface components such as dialogs, mouse pointer, and windows, are replaced with circles and rectangles outlining "objects" that are manipulated via drag and drop. The "objects" in question can be either virtual objects displayed on the screen, or physical objects such as cellphones, digital cameras, and PDAs placed on the screen. Physical objects are automatically identified and connected to the Surface computer upon their placement on the screen. With no interface text, the Surface computer can be used by speakers of any language and any competency level.

Surface's main feature is the apparent simplicity with which common computing tasks can be performed. Most operations are performed without dialogs or wizards. For instance, pictures in a digital camera placed on the surface are automatically downloaded to the device and displayed on the screen. Transferring those pictures to another device, such as a compatible cellphone, simply requires the user to place the cellphone on the surface and to drag the pictures in it's direction. While the potential security implications of this type of interaction are obvious, and Microsoft's solutions to the issue are vague at best. Devices are identified by a one-byte "domino" tag on their sides, which is easily forged with a pencil. Although the underlying bluetooth and wifi technologies are considered safe for the transfer of the data itself, the ease in which documents can be
accidentally or maliciously copied is alarming. This is typical of Microsoft products, which generally sacrifice security for convenience and simplicity of use.

6. STRUCTURE

Hardware of surface computer consists of 4 parts

Fig: 6.1 Skeleton View of Surface Computer

1. Screen
2. Infrared
3. CPU
4. Projector

(1) **Screen**: A diffuser turns the Surface's acrylic tabletop into a large horizontal "multi touch" 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.

(3) **CPU**: Surface uses many of the same components found in everyday desktop computers. Wireless communication with devices on the surface is handled using WiFi and Bluetooth antennas.

(4) **Projector**: Microsoft's Surface uses the same DLP light engine found in many rear projection HDTV’s (High Definition Televisions). The display screen is a rear-projected DLP display. The cameras can read a nearly infinite number of simultaneous touches and are limited only by processing power. Right now, Surface is optimized for 52 touches, or enough for four people to use all 10 fingers at once and still have 12 objects sitting on the table.
7. Hardware & Software Specifications

**Features:** Multi-touch display, Horizontal orientation.

**Requirements:** Standard 110–120V power.

**System:** The Surface custom software platform runs on Windows Vista™ and has wired Ethernet10/100 and wireless802.11b/g and Bluetooth2.0 connectivity. Surface applications are written using either Windows Presentation Foundation.

**Dimensions:** 30-inch (76 cm) display in a table-like form factor, 22 inches (56 cm) high, 21 inches (53 cm) deep, and 42 inches (107 cm) wide.

**Materials:** The Surface tabletop is acrylic, and its interior frame is powder-coated steel.

**Availability:** Consumers will be able to interact with Surface in hotels, restaurants, retail establishments and public entertainment venues.

At Microsoft's MSDN Conference, Bill Gates told Microsoft Surface was going to have:
SURFACE COMPUTER

Intel Core Quad Xeon "Wood Crest" @ 2.66GHz
4GB DDR2-1066 RAM
1TB 7200RPM Hard Drive

It has a custom motherboard form factor about the size of two ATX motherboards.

8. APPLICATION DEVELOPMENT

Microsoft Surface applications can be written in Windows Presentation Foundation or XNA. The development process is much like normal Vista development, but custom WPF can controls had to be created by the Surface team due to the unique interface of Surface. Developers already proficient in WPF can utilize the SDK to write Surface apps for deployments for the large hotels, casinos, and restaurants.

Windows Presentation Foundation

The windows Presentation Foundation (or WPF) is graphical subsystem for rendering user interfaces in Windows based applications. WPF, initially released as part of .NET Framework 3.0, is another step in Microsoft’s evolving rich client strategy. Designed to remove dependencies on the aging GDI subsystem, WPF is built on DirectX, which provides hardware acceleration and enables modern UI features like transparency, gradients and transforms. WPF provides a consistent programming model for building applications and provides a clear separation between the user interface and the business logic.

WPF also offers a new markup language, known as XAML which is an alternative means for defining UI elements and relationships with other UI elements.[1] A WPF application can be deployed on the desktop or hosted in a web browser. It also enables rich control,
design, and development of the visual aspects of Windows programs. It aims to unify a number of application services: user interface, 2D and 3D drawing, fixed and adaptive documents, advanced typography, vector graphics, raster graphics, animation, data binding, audio and video.

WPF provides a sophisticated layout system that handles the arrangement of all visual elements.

The Layout engine uses a two phase system.

First is the measure phase, where every element in the UI tree is queried for its desired size.

Second is the layout phase, where each element is instructed as to its actual size and location.

This is a recursive process.

WPF ships with a handful of layout panels (Stack Panel, Wrap Panel, Canvas, Uniform Grid, Grid, Dock Panel) with each panel specializing in a particular type of layout.

WPF also provides a transformation engine.

All transforms in WPF are eventually turned into Direct3D instructions which then become native GPU TRANSFORM instructions.

WPF exposes a number of Transform classes (Matrix, Rotation, Scale, Translate, Skew).

All graphics, including desktop items like windows, are based on Direct3D.

This aims to provide a unified avenue for displaying graphics and is the enabling factor that allows 2D, 3D, media and animation to be combined in a single window.

Supports vector-based graphics, which allow lossless scaling.
SURFACE COMPUTER

Supports 3D model rendering and interaction in 2D applications.

Interactive 2D content can be overlaid on 3D surfaces, natively

**XNA**

Microsoft XNA (XNA’s not Acronymed) is a set of tools with a managed runtime environment provided by Microsoft that facilitates computer game development and management. XNA attempts to free game developers from writing “repetitive boilerplate code and bring different aspects of game production into a single system.

XNA currently encompasses Microsoft’s entire game development sections including the standard Xbox Development Kit and XNA game studio.

The XNA framework is based on the native implementation of .NET Compact Framework 2.0 for the Xbox 360 development and .NET Framework 2.0 on windows. It includes an extensive set of class libraries, specific to game development, to promote maximum code reuse across target platforms. The framework runs on a version of the common language runtime that is optimized for gaming to provide a managed execution environment. The runtime is available for windows XP, windows vista, and Xbox 360. Since XNA games are written for the runtime, they can run on any platform that supports the XNA framework and minimal or no modification games that run on the frame work
can technically be written in any .net compliant language, but only C# and XNA game studio express IDE and all version of visual studio 2005 are officially supported.

XNA Build is a set of game asset pipeline management tools, which help by defining, maintaining, debugging, and optimizing the game asset pipeline of individual game development efforts. A game asset pipeline describes the process by which game content, such as textures and 3D models, are modified to a form suitable for use by the gaming engine. XNA Build helps identify the pipeline dependencies, and also provides API access to enable further processing of the dependency data. The dependency data can be analyzed to help reduce the size of a game by finding content that is not actually used.

For example, XNA Build analysis revealed that 40% of the textures that shipped with MechCommander 2 were unused and could have been omitted.

APPLICATIONS

Digital photo handling with finger tips

Sharing photos is a much more unrestricted activity. Photos are arranged into albums that look like piles. Tapping the pile once spreads it around the screen and from there user can drag, rotate, and resize the images. Since Surface can detect many touches at the same time, multiple people can sort and resize pictures.

Instantly compares while shopping

Two cell phones can be placed on the surface and compare the different price points and features, experiment with ring tones and look at plans then program the phone to your liking and have it all set to use before you walk out of the store.
Interaction with digital content by share, drag and drop digital images

Digital images are manipulated, sheared & send via technologies like wi-fi, Bluetooth, etc.

Surface Restaurant

Orders can be placed on the Surface from a sliding menu

Quickly browse through play list entries

Huge play lists can be easily manipulated by dragging favorite song to the current track

9. ADVANTAGES & DISADVANTAGES

ADVANTAGES

- Multi users- can handle multiple users at the same time.
- Seamless- no wires or USB ports.
- Instant download/upload of photos.
- Users have more control of technology- ordering food or manipulating photos fast.
- Educational- learn more info about the products you are using.
DISADVANTAGES

- Incredibly expensive ($10,000-$15,000).
- Currently designed only in some areas.
- Need for dim lighting to avoid washing out the screen.

10. FUTURESCOPE

Surface Computing Tomorrow

Computer scientists hope to incorporate this kind of technology in peoples’ daily lives…
Future goals are to surround people with intelligent surfaces—look up recipes on kitchen counter or table, control TV with coffee table, etc
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.
CONCLUSION

Microsoft Surface is the future of computers.
Surface Computing brings to life a whole new way to interact with information that engages the senses, improves collaboration and empowers consumers.
It 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.
By utilizing the best combination of connected software, services and hardware developing surface computing products that push computing boundaries, deliver new experiences that break down barriers between users and technology.

‘A computer on every desktop’

Now we say ‘Every desktop will be a computer’

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