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Enhancement in Surface Computing

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Abstract—*Our research summarizes the work of surface computing. Surface computing is the term that is used for a specialized computer GUI in which traditional GUI components or elements are replaced by real world objects. The user interacts directly with the touch-sensitive screen rather than using keyboard or mouse. The device that uses this technology is known as surface computer. In this research we have covered the basic features, history, working and structure of the surface computing, applications, advantages and disadvantages.*

Keywords*: GUI,touch-sensitive,technology,real.*

1. INTRODUCTION

Fig. 1: The journey from concept to product[3].

For years engineers and computer technicians have searched for a better way for interacting humans with their computers. With surface, Microsoft has established a new branch of computer technology known as surface computing. Surface computing is predicted to break down traditional barriers to technology. It allows for far less time thinking about how to interact with a computer so more energy can be put into how to use them. The goal of surface computing is to recognize touch and objects on the screen's surface and to interact with those objects seamlessly. A surface computer is a computer that interacts with the user through the surface of an ordinary object, rather than using monitor or keyboard. It doesn't even require a USB port connected to the device because it is capable of recognizing the objects such as pen drive physically by just placing them on the surface of the computer. They are identified by their shapes or embedded ID tags. Surface also acts as a mediator between devices (e.g. data exchange between digital camera and mobile phone).

2. HISTORY

Microsoft surface computer is much like a blend of Disk Operating System and GUI (Graphical User Interface). It is a collaborative work of Microsoft Hardware and Microsoft Research. It is an idea inspired by Cross-Division Collaboration. In 2001, Stevie Bathiche from the department of Microsoft hardware and Andy Wilson from the department of Microsoft Research began working together on various projects. In one of their regular brainstorm session, they thought of an idea of an interactive table that could possibly understand the manipulation of physical elements. They both saw the need for device where interaction was richer and more instinctive and at the same time practical for everyone to use. This idea later resulted in the development of Surface. Over the course of following years, various people at Microsoft involved in developing new device with this concept and continued to think about the possibility and feasibility of the project. In 2003, David Kurlander who led the new Consumer Product Group presented the idea to the Microsoft chairman, Bill Gates. Gates instantly liked the idea and encouraged the team to continue with their development. The virtual team in which Bathiche and Wilson were the key members expanded and within a month the team created the first humble prototype 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.

2.1 First humble prototype based on an IKEA table

Fig. 2: Beginning on IKEA table[3].

The evolution of surface computer has begun by that time. Many applications were developed including pinball, a photo browser and a video puzzle. As the applications were built the team saw the value of surface computer beyond gaming and began to favour those applications which enable the surface computer to physically recognize the objects placed on the table. Over the next year, the team grew significantly including Nigel Keam who is initially a software development lead and later architect for surface and had a responsibility of taking the product from prototype to a shipping product. Its applications were continuously refined. More than 85 prototypes were built for use by software developers, hardware developers and user researchers.

One of the key attribute of surface is recognition of object and the ability of objects that are placed on the surface to trigger different types of digital responses, including the transfer of digital content. This key feature went through numerous rounds of testing and refining. The original plan was of using only the single camera in the vision system but it was proving unreliable. After going through variety of options it was decided that surface would use five cameras instead of one that would more accurately detect natural movements and gestures from the surface.

By late 2004, number of different experimental prototypes were built including "the tub" model. Hardware design was finalized in 2005 and the concept of surface computing was introduced in the paper "Think Week". The next phase of development focused on continuing the journey from concept to product. "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." Surface computer was announced on May 29, 2007 at D5 conference. Launch was on April 17, 2008. The latest version is Microsoft surface 2.0.

3. SURFACE COMPUTING TECHNOLOGY

We are already familiar with the concept of a Graphical User Interface (GUI). A GUI, like the windows and menus on our computer, presents information to us available on screen and prompt us to use an attached keyboard, mouse, touchpad or other input devices to enter information. Whereas surface computing uses Natural User Interface (NUI) which will enable you to interact in a way what comes naturally to you. A NUI is implemented by the direct touch of the user or object its interacting with rather than separate input devices connected to the computer.

The surface implements its NUI with a combination of hardware and software all packed into a single device. The surface 1.0 hardware uses a series of camera that senses a user's touch or other object that is placed on the surface. The surface software processes the data from those camera and then responds for the application you're currently using. Surface shows the resulting interaction on its display, which is actually a projection of the screen from underneath the tabletop.

As a part of its NUI, surface also enables multi-touch technology i.e. the surface can detect and process several touch points at a time. Therefore if you have several people browsing through pictures at one time, they zoom, drag and turn photos at the same time without waiting for each other.

3.1 Surface Hardware

- 40-inch (1-meter) LCD screen
- 4-inch (10.2-centimeter) unit depth/thickness for easier horizontal mounting
- 2.9 GHz 64-bit AMD Athlon X2 dual core processor
- 1 GB AMD Radeon HD graphics processor
- 4 GB DDR3 RAM
- 320 GB hard drive
- Wired (1 GB Ethernet) and wireless (802.11 and Bluetooth) network hardware
- Physical connectors include HDMI, stereo RCA, USB and SD card
- Embedded 64-bit Windows 7 Professional operating system
- Corning Gorilla Glass to protect the surface
- Recognition for more than 50 simultaneous touch points.

3.2 Surface Software

The Microsoft surface platform relies on groundbreaking software to make all of its technologies work together flawlessly. All the surface software runs in Surface Shell. In operating system, a shell is a process which is use to run and manage a group of related sub-processes. It also provides other functionality. Every surface application must integrate with Surface Shell. It is a main process that can make use of surface hardware functions. The applications running in the surface shell entices you to touch the screen. The default application for this is the virtual pond in which by touching the surface water ripples.

When you touch the Surface Shell, access points appear in every corner of the screen. You can touch any access point closest to you to open launcher. Since the software surface works in a 360-degree rotation, use the access point closest to your right hand to orient the launcher in such a way that it faces you. The launcher presents all the surface software installed on that unit. The launcher is a carousel of surface applications. One can spin the carousel by swiping your hand back and forth across the screen. When the application you want to use is at the centre of the carousel, you merely touch the application image to launch it. If you want to exit the launcher and want to return to the previous screen, you can touch one of the access point waiting for you at the corner of the screen.

Microsoft includes series of applications for playing music, photo organizing, drawing, map searching, shopping, banking and even includes some of the games. Each of these application uses one or more surface hand motions such as:

- Touching: To select an object, just touch it on the screen.
- Dragging: Many of the applications allow you to drag an object across the screen bytouching it and dragging your hand along the surface.You can also scroll through menus with a dragging action.
- Scaling: Some objects can be scaled by touching them at two points and dragging thosetwo points closer or farther away. You could enlarge a photo for example by touching diagonal corners with apposite hands, then moving your hands away from each other.
- Flicking: When you want to set something aside, you can swipe across the surface of theobject as if pushing a piece of paper. Surface will detect the momentum and move the object to the side of the screen where it is still accessible but out of the way.
- Turning: If an application allows you to turn an object, you will do this by touching it at two or more points and dragging it in a circular motion along the surface.

4. ARCHITECTURE

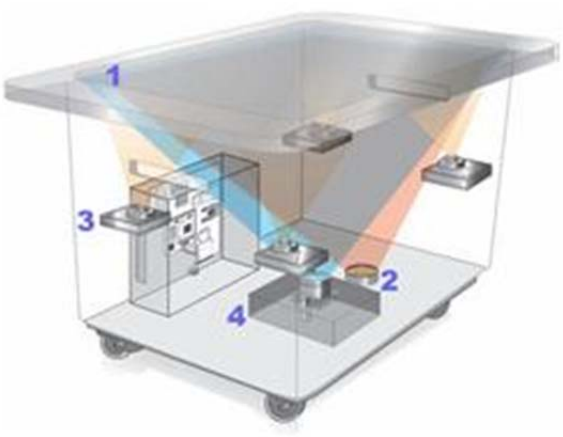

Fig. 3: Architecture with its components[3].

- SCREEN: It is a top layer and works as a diffuser. It diffuses illumination. Diffuser turns the surface's acrylic table top into a horizontal multi-touch screen which is capable of processing multiple inputs given by multiple users. The surface can also recognize physical objects placed on surface by their shapes or by their embedded tags.
- INFRARED: It is an 850-nm-LED which is aimed at the screen. When the surface is touched the light is reflected back which is detected by the 5 infrared cameras. It is also known as 'machine vision' operates in the near-infrared spectrum.
- CPU: It consist of the following features
  - Core2Duo Processor.
  - 2GB of RAM.
  - 256MB of Graphics card.
  - WiFi.
  - Bluetooth antennas.
- PROJECTOR: It is a DLP(Digital Light Processing) engine.

4.1 Attributes

4.1.1 **Direct Interaction**: It means we can interact directly with the surface by using our fingers.

4.1.2 **Multi-touch**: Surface has been optimized to respond 52 touches at a time.

4.1.3 **Multi-user**: The horizontal form of structure makes it easy people to gather around the surface providing a collaborative, face to face computing experience.

4.1.4 **RAN Evolution**: Physical object can be recognized by placing it on the surface.

4.2 Advantages

- Can handle multiple users a same time.
- No wires or USB ports is required.
- Instant download or upload of photos.
- Users have more control of technology.
- Saves time by eliminating processes.

4.3 Disadvantages

- Not portable and expensive ($12,000-$15,000)
- Not accurate for fat fingers as compared to the mouse or stylus.
- Objects needs to be tagged.

5. CONCLUSION

The enhancement in surface computing technology will make our lives more comfortable. We would be able to see the things with 3-dimensional view.

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