

COMPARATIVE STUDY OF LATEST TECHNOLOGIES IN SURFACE COMPUTING

Mr.R.KARTHIKEYAN,¹ Mr.D.L. PRAVEENKUMAR.,² Mrs.M. PRIYANGA.,³

Assistant Professor, Department of Master of Computer Application, Gnanamani College of Technology, Namakkal
Tamilnadu, India¹

PG Scholar, Department of Master of Computer Application, Gnanamani College of Technology, Namakkal,
Tamilnadu, India²

PG Scholar, Department of Master of Computer Application, Gnanamani College of Technology, Namakkal,
Tamilnadu, India³

ABSTRACT

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. Surface computing is the term for the use of a specialized computer GUI in which traditional GUI elements is replaced by intuitive, everyday objects. It supports multiple touch points Microsoft says "dozens and dozens" as well as multiple users simultaneously, so more than one person could be using it at once, or one person could be doing multiple tasks. The term "surface" describes how it's used. There is no keyboard or mouse. All interactions with the computer are done via touching the surface of the computer's screen with hands or brushes, or via wireless interaction with devices such as smart phones, digital cameras or Microsoft's Zone music player. Because of the cameras, the device can also recognize physical objects; for instance credit cards or hotel "loyalty" cards. A physics-based simulation adds dynamics to digital content, providing users with rich ways of interacting that borrows from the real-world. The field study is one of the first of a surface computer within a do-mastic environment. Technology has been taking new turns into the future and so has the mode of interaction become very specific. Human- Computer interaction has brought forward more obstacles and it has become a necessity to satisfy the user's expectation.

Keywords: *Interactive surfaces and tabletops, physics-simulation, field-study, home, Graphical user interfaces (GUI), Surface Computing, Multi-Touch Interactions.*

1 INTRODUCTION

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. Surface computing is the term for the use of a specialized computer GUI in which traditional GUI elements is replaced by intuitive, everyday objects. Instead of a keyboard and mouse, the user interacts directly with a touch-sensitive screen. It has been said that this more closely replicates the familiar hands on experience of everyday object manipulation. With Surface, Microsoft has established a new branch of computer technology known as surface computing.

The goal of surface computing is to recognize touch and objects on the screen's surface and to interact with those objects seamlessly. If you're using a surface computer, you shouldn't need a mouse, keyboard or even a USB port connected to the device.

In this paper we pre-sent one of the first deployments of a multi-touch tabletop device in a domestic setting. Our overall goal is to investigate the potential for surface computing in the home. Specifically, in this paper we seek to observe what people's interactions, perceptions and experiences are of such novel computing technologies and interfaces, as a means to fur-their inform the design space. Over the past couple of years, a new class of interactive device has begun to emerge, what can best be described as —surface computing!.

Two examples are illustrated in this report. The y are-

- Surface Table top
- Perceptive Pixel



Fig 1 Surface Computing Table

The *Surface table top* typically incorporates a rear-projection display coupled with an optical system to capture touch points by detecting shadows from below. Different approaches to doing the detection have been used, but most employ some form of IR illumination coupled with IR cameras. With today's camera and signal processing capability, reliable responsive and accurate multi-touch capabilities can be achieved.

2 LITERATURE REVIEW

Over the past couple of years, a new class of interactive device has begun to emerge, what can best be described as "surface computing". Two examples are illustrated in this report. They are Surface Table top, Perceptive Pixel. The Surface table top typically incorporates a rear-projection display coupled with an optical system to capture touch points by detecting shadows from below. Different approaches to doing the detection have been used, but most employ some form of IR illumination coupled with IR cameras. With today's camera and signal-processing capability, reliable, responsive and accurate multi-touch capabilities can be achieved.

The multi-touch pioneer and his company, Perceptive Pixel, have devoted the better part of two years for building an entirely new multi-touch framework from the ground up. Instead of simply mapping multi-touch technology to familiar interfaces and devices, Han's goal is far more sweeping: 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 a bout of sitting in the corner. On the other hand, it is perfectly safe to put things on a table.

The most recent solution, and one that seems likely to stick is that of surface computing. Surface computing at its most basic is an attempt to make the use of a computer better match the way we interact with other things in our environments as well as better interacting with those things and allowing for far less time thinking about how we interact with our computers so more energy can be put into how we use them. The most common and popular type of surface computing is that of touch screen monitors of the type that can be found on many modern phones. These are also common in many businesses where untrained workers are expected to use a computer. Until recently though these touch screen monitors were really little more than a replacement of the mouse. You could still only point at one thing at a time, and it wasn't even as good as a mouse because you can't right click or highlight things without using a keyboard.

The key difference between this and other similar devices is the multi touch system. This allows users to use both hands to manipulate things such as photos, as well as the use of hand gestures and even physical gestures.

Other features on the Microsoft surface allows for wireless communicates between devices so things like phones, cameras and laptops can sync with the table and move data between them effortlessly. Surface computing is a powerful movement.

3 METHODOLOGIES

Multi-touch user interaction

The horizontal form factor makes it easy for several people to gather around surface computers together, providing a collaborative, face-to-face computing

Tangible user interface

Surface aims to provide physical form of digital information.

- i) One can draw on surface with any physical paint brush.
- ii) Placed on the Surface, squares of glass can play videos (puzzle).

Hand gestures are preferred to physical instruments.

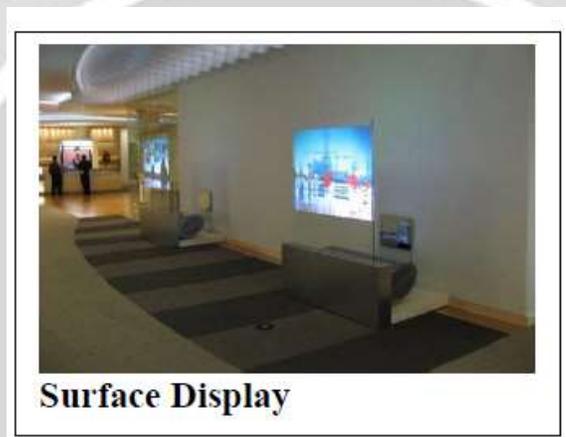


Fig 2 Surface Display

Multi-user Interface

Users can place physical objects on the surface to trigger different types of digital responses. They are identified by their shapes or embedded ID tags. Surface acts as a mediator between devices (e.g. data exchange between

- i) Digital camera and Mobile phone).

The main idea behind the surface technology is to let people interact with their digital content in a much more new and innovative way which are quite different from the traditional ways. The concept is to give digital content a new dimension where it is not restricted to your mobile phones or television sets rather has the ability to interact with you physically. Microsoft Surface uses cameras to sense objects, hand gestures and touch.

- 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.

- 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.

4 ALGORITHMS

1 Screen

A diffuser turns the Surface's acrylic table top 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 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 table top, the light reflects back and is picked up by 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 Wi-Fi and Bluetooth antennas.

4 Projectors

Microsoft's Surface uses the DLP (Digital Light Processing) light engine found in many rear projections TV's. The cameras can read nearly infinite number of simultaneous touches and is limited only by processing power.

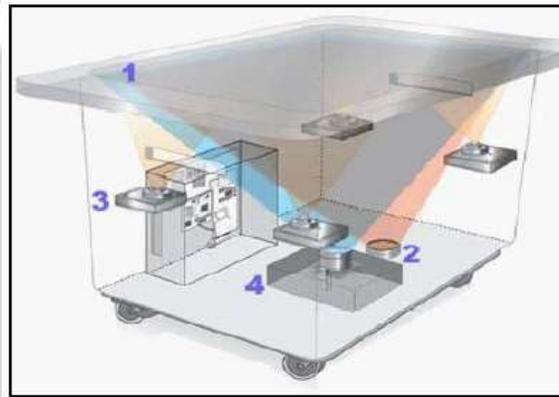


Fig 3 Structure Process

5 CONCLUSIONS

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. 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. We have evaluated a novel multi-touch and physics enabled interactive tabletop in three real family homes, providing a grounded understanding of tabletop UI design in domestic spaces. In doing this we have explored how such devices can be used in everyday homes and with regular users. By capturing a rich data set regarding peoples' interactions and perceptions of such devices the study has assessed the value of multi-touch, physics and surface computing, thinking deeply about the design of such devices. It has allowed us to see where the emulation of physics fits well, and equally where it may hinder the kinds of things that families want to accomplish. This raises a design challenge of building an interface for a system which supports both work and play, and which at once can incorporate affordances of both the physical and digital world in ways that optimize both. 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.

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