Surface Computing: Comparative Study of Flat and Non Flat Interfaces

Mr. Roshan Renji
PG Scholar ,MCA Department
SCMS School Of Technology And Management
Aluwaye ,Kochin, India

Ms. Anjana S Chandran
Assistant professor ,MCA Department
SCMS School Of Technology And Management
Aluwaye, Kochin, India

***Abstract*-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. Therefore, this paper provides a comparative study of Flat surface computing interface and non flat surface computing interfaces which mainly focuses on various ideologies that are taken into account. It reflects on certain aspects such as visibility techniques in both flat and non flat surfaces, the all round view. The seminar mainly concentrates on various angles such as the technical obstacles and it's solution to an extent.**

Keywords— ***Graphical user interfaces (GUI),surface computing, multi-touch interactions, gestures, Bezier Curve, wire-frame model, three-dimensional (3D), ZOIL(Zoomable Object-Oriented Information Landscape), personal information management (PIM),***

I. INTRODUCTION

Computers allow us to have multiple applications done in multiple windows. We use only one key board and one mouse and only one person can do work at a time. If we want to watch photos on our computer along with three or four other people, just imagine every one trying to see them. Microsoft introduce surface computing, Microsoft Surface allows people to sit across in different positions and watch the images. Spread the photos across the Microsoft Surface and any one can pull photos towards them like you pull physical photos, with fingers. The name Surface comes from "surface computing" and Microsoft envisions the coffee-table machine as the first of many such devices. It uses many wireless protocols . The table can be built with a variety of wireless transceivers, including Bluetooth, Wi-Fi and (eventually) radio frequency identification (RFID) and is designed to sync instantly with any device that touches its surface. It supports multiple touch points – Microsoft says "dozens and dozens" -- as well as more than one users simultaneously, so more people could be using it at once, or one person could be doing so many tasks.

Surface Computing can be implemented in both Flat and Non Flat Interfaces Flat surfaces are more user-friendly and commonly used in these days.Non flat surfaces are one for the future still under the study. The design of non flat surface interfaces is a very complex task. Human gestures plays a pivotal role in Surface computing .The complexity of Human Gestures increases while transforming from 2-d to 3-d.understanding the usage of human gestures is an uphill task.

II. SURFACE COMPUTING OVERVIEW

[6]A table top computer from Microsoft that incorporates hand gestures, optical recognition, and multi touch of objects placed on the screen. The Surface's 30" touch screen is used without a mouse and keyboard is large enough for group participation

[5]However, a better way for people to communicate with their computers. Usage of keyboards keep us feel comfortable and has advanced very little beyond the typewriters which had been around for well over a hundred years and though the mouse is a step above that it still takes practice for someone who has never used one to become used to the idea of moving the mouse with it and after years of using a computer many older people still have trouble with the concepts of right clicking, double clicking, dropping, dragging and other techniques that can seem simple to more advanced computer users. The very most recent solution and one that seems likely to stick is that of surface computing technology .

[4]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. This is very common in many businesses where untrained workers are expected to use a computer.[2]Until recently though these touch screen monitors were really little more than a replacement of the mouse. We 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 .

Surface computing is a fast moving technology. In fact, it's as significant as the move from Disk Operating System to Graphic User Interface. [6]Our researchers show that many people are intimidated and isolated by now a days technology. Many operations available in PCs , mobile phones and other electronic devices like digital cameras etc aren't even used because the technology is intimidating. Surface computing overcome those traditional barriers to technology so people can interact with all kinds of digital content in a more intuitive, engaging and strong manner.

Surface Display

Surface Computing Table

III. HOW IT WORKS

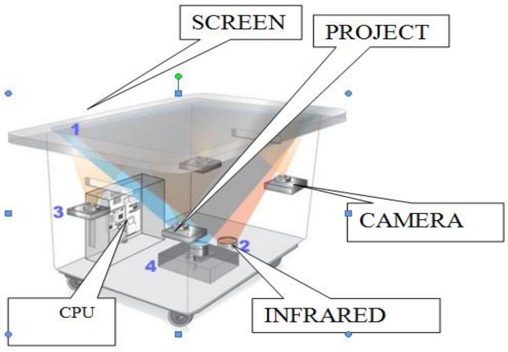
*1. Screen***:** A large horizontal "multitouch" screen is used , The Surface can recognize the objects by reading coded "domino" tags.

2. ***Projector:*** The Surface uses a DLP light engine found in many rear projection HDTV's. The foot print, of the visible light screen (1024 x 768 pixels) Projector. Wireless Communication is used here

3. Infrared (IR cut filter): Surface uses a 850-nm light source.

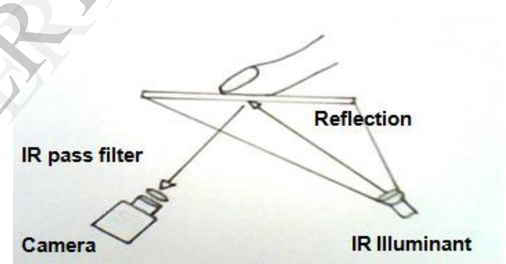
4. CPU: Core2Duo processors 3GB of RAM, 500MB graphics, The same configuration used in our everyday desktop computer.

5. Camera (IR pass filter): [4] Camera is used to the capturing the process, then. Images are displayed onto the underside of the screen then. Hand gestures play a important role .Fingers, hand gestures and objects are visible through this screen to cameras placed underneath the display. Using image processing system we processes the image which detects, objects, and fingers such as paint brushes. [5]These type of objects are then recognized and the correct application begins running. It is a computer with different feel & look.



Touch Screen Concept

[2]Using Infrared cameras we sense objects, hand gestures and finger touch. Using a Rare projection system which displays on to the underside of a small thin diffuser. Objects like fingers are visible through the diffuser by series of Infrared cameras, positioned to the underneath the display. [3]The Objects recognized are reported to the applications running in the computer so that they can react to objects shape, touch and movement of the finger



For example Consider a screen when the fingers are inserted on to the screen the place where the fingers were pointed gets shadow and the remaining places are usually generate a light. It is processed by the Infrared cameras and infrared rays of light are project under the table and, then reflect by the fingertip. The IR light changes are then process by the webcam and sent to the software

IV .THE FOUR KEY ATTRIBUTE

Direct Interaction

a) It means, Using fingers we can interact with the Surface
b) other type of traditional input device is no needed
c) This provides a natural user interface effect

Multi user Interaction

a) One touch screen can support more than one user
b) It provides a Independent interface, that is Each and every user can independently interact with the surface.

Multi-touch Contact:

a) Multi touch is possible here Normal touch screens provide only single touch sensing

b) In surface computing method more than one touch can be recognized at the same time.

Object recognition

a) Object recognition is very effective A special bar codes called Domino tags which are used to Object recognition in surface computing.

b) We can easily identify the infrared sensitive patterns The Surface contains the infrared sensing camera which is used to read infrared sensitive patterns.

Using domain tags we recognize the object . Using infrared sensing cameras we can able to read the object placed on the surface of the screen. Consider two mobiles are placed on the surface screen then the entire features of the object are displayed, on the screen through this we can identify all features of the mobile. No need for any external wires as the entire touch screen components are situated safely behind the glass which enables the user for easy accessing an infrared ray of light is

Projected under the table, then the reflected by the fingertip. All minute the infrared light changes are then executed by the webcam and sent to the software.

Placing Mobile on the Screen

We Just place a mobile on the screen the different images can be see and directly it can be loaded into a mobile phone device. Similarly videos can also be downloaded. This is a very easy process of downloading.

Loading Images to mobile

The image size can be changed just by the finger gestures. For ex:- take a digital camera and just by put the camera on screen all the images inside the camera gets displayed , then the images can be formatted or the needed image can be directly downloaded into the mobile device. The work becomes more and more faster and more than one users can use any image on the screen and can change the size of the entire images on the screen

Advantages

1) Multi users:

Collaborative effort of users interacting A single touch screen can support more than one user, each and every user can interact with the surface independently

2) Seamless:

USB ports or No wires are spread the photos across the Microsoft Surface and any one can pull photos towards them like you pull physical photos, with fingers.

3) Down Loading/Uploading possible

We can Downloading or uploading the photos can be done simultaneously and very instantly

4)Very Fast:

It is very fast .So users have more control of technology , food ordering or manipulating photos fast

5) Educational

Learn more info about the products you are using, as the next generation will be entirely the Surface Computing technology

V. FLAT SURFACE INTERFACE

THE ZOIL USER INTER FACE PARADIGM:-

ZOIL (Zoomable Object-Oriented Information Landscape). The ZOIL is aimed at unifying all types of local and remote information items with their connected functionality and with their mutual relations in a single visual workspace as a replacement of today's desktop metaphor. This work environment can serve as an integrated work development environment for traditional personal information management (PIM), but can also be used for PIM tasks in a wider sense. By developing ZOIL's fundamental design principles we describe the visualization techniques, interaction style and interface physics of a ZOIL user interface. We discuss ZOIL's ability to provide nomadic Personnel Information Management environments for mobile and stationary use.

VI. .NON FLAT SURFACE COMPUTING INTERFACE

We now focus on our explorations of interactions on curved surfaces, and in particular describe a spherical multi- touch sensitive display called [8]S*phere.* The promise of curved, deformable, or organic-looking displays opens up numerous novel uses and interaction possibilities; however, most of the current applications are ill-suited for such non- traditional surfaces. We argue that the design of compelling applications for non-flat user interfaces greatly depends on the designers' ability to overcome inherent interaction challenges and exploit some unique characteristics of such unusual display form factors

VII. COMPARITIVE STUDY OF FLAT AND NONFLAT SURFACES

1.The basic difference is that flat is 2-d and non-flat is 3-d

2-d and 3-d are basic interfaces that are used in surface computing. Even the interactive surfaces that support interactions with tangible objects, commonly track such objects only when in contact with the 2D plane, leaving the 3D interaction space above the surface largely underutilized. For example, Play anywhere prototype allows the user to play a virtual game of chess with a remote opponent. While the user can move real physical chess pieces in front of them, the basic mode of interaction remains two-dimensional.

2. Identification of gestures and depth is more difficult in 3-d than in 2-d

Gesture identification is difficult in both. Most of the interactive touch-sensitive surface systems restrict the user interaction to a 2D plane of the surface and actively disregard the interactions that happen above it. This is usually justified by the system designers' need to reliably detect when the user is in contact with the surface and not accidentally disturb the interface otherwise. The current touch sensitive interactive surface, the user do not require any external or additional gear to interact with the non-flat to this functionality it enables group of users to interact simultaneously without leading to complexity. When it comes to 3-d the interaction with the non-flat happens in the space above the display itself. It is important to preserve the volumes of object and facilitate then through touch and free hand gesture sensing so the main challenge occurs in the right gestures to track them without any additional gear touch. Such gestures to the users make the interaction natural and easy.

3.Border identification is simpler in 2-d and it is difficult to identify the border in 3-d:

Spherical displays present a difficult design challenge as they require a user interface to be thought of as a continuous surface without borders. Standard flat displays often require an opposite mental model, the content can often stretch beyond the borders of the display, i.e., the display can be thought of as a window into the larger digital world. But for a spherical display, such ―off-screen space usually does not exist; rather, any data moved far enough in one direction will eventually make it full circle around the display. This characteristic can be exploited for interesting effects. For example, we implemented a ―potter's wheel[5] metaphor in our painting application where the entire canvas can rotate in place, thus allowing the user to continuously paint all around the display without changing his location.

This characteristic of a borderless, but finite display also create difficulties when application needs to facilitate zooming (e.g., zooming in a global mapping application, such as Virtual Earth). With flat displays, zooming mental display, standard zooming techniques introduce zippering problems on the opposite side of a display

4. Design view from multiple direction

For an instance, if couple of users want to view an object on the surface simultaneously will not be able to view the same area of the object at the same time as the shape is 3-d type. Therefore a user trying to access the same data that is being viewed by another could cause conflict. Thus this is a very sensitive area to be studied. If a person is viewing in vertical format and simultaneously if another user in viewing in horizontal format then a collision can occur. Most of the today's media and user interfaces are designed to be viewed and used in one canonical orientation only. This works well for most vertical screens as viewers all share the same *up* direction and are usually able to see the entire screen (albeit with some perspective distortions). However, on horizontal surfaces such as interactive tabletops, the data and interface orientation issues are much more problematic. In fact, it is still an open research question to design a compelling tabletop presentation for multiple people around the table. However, with non-flat interactive surfaces, this is even further complicated, since each user sees a different view or even a different portion of the display

5 Non-Visible Layers:

Unlike true 3D volumetric displays , the diffuse nature of the spherical surface makes it impossible for users to see inside the display and ensures that each user, at any given time, can see at most one half (one hemisphere) of the display. [6]While not being able to see the entire display simultaneously may be a disadvantage for some applications, we believe that in many scenarios this presents a unique benefit. [2]For example, not being able to see all your opponent's actions makes our Sphere pong game simultaneously challenging and very engaging

6. Visible Content Changes with Head Position [7] In the spherical surface interface, a small changes in head position may reveal new content or hide previously visible content. This means that while the user can hope to get some advantage by [3] shifting their position and peeking at the opponent's actions, they are simultaneously leaving another part of their interface unattended, i.e. vulnerable. Such actions are also socially obvious and participants can rely on standard social cues to ensure ―pseudo privacy for their actions or content.

7. Research on 360 degree viewing interface

[8]The Omni-directional media, such as cylindrical maps of any spherical object or 360° panoramic images – are very well suited for display on Sphere. [8]Examples we explored were a live-stream from an Omni-directional video conferencing camera, Omni-directional images of a city captured by a camera mounted on a car roof, and the Earth's surface.

[2]However, the fact that Omni-directional media usually spans the entire display surface presents interesting implications for multi-user and multi-touch collaborative scenarios. Allowing one or more person to touch the data often results in an interaction conflict (e.g., multiple people trying to spin the globe in multiple directions at the same time). [7]While restricting interactions to a single touch does mitigate some of the problems (e.g., the first touch assumes control), such a solution is often confusing to the other users who might not be able to see the action being performed. [5]While this issue should be investigated further, in our current system, users are left to socially mitigate such situations: either taking turns or allowing one person to ―drive‖ the interaction.

8. Hardware Availability

In the Flat interfaces the hardware cost and the availability of the hardware is very high as compared to the non flat interfaces

VIII. OVERCOMING PITFALLS OF NONFLAT SURFACE

To solve the "**Identification of gestures and depth is more difficult in 3-d than in 2-d"& "Border identification is simpler in 2-d and it is difficult to identify the border in 3-d"** problem in the non flat system we can use the "Bezier curve and Surafces"algorithm in Graphics and Wire Frame model. The main issue in the non flat system is to identify the depth of the gestures .In Flat interface the depth of the hand touch gesture is same in every coordinate ,but in non flat it is not. Another problem is identifying the boarder in non Flat system. The architecture says the shape for the non flat system is Sphere. The border identification of sphere is very difficult.

[6]A **wire-frame model** is a visual presentation of a three-dimensional (3D) or physical object used in [4]3D computer graphics. It is created by specifying each edge of the physical object where two mathematically continuous smooth surfaces meet, or by connecting an object's constituent vertices using straight lines or curves. The object is displayed on the screen by drawing lines at the edge. The term wire frame comes from designers using metal wire to represent the three-dimensional shape of solid objects. 3D wire frame allows constructing and manipulating solids and solid surfaces. The 3D solid modelling technique efficiently draws higher quality representations of solids than the conventional line drawing.

The wire-frame model allows visualization of the underlying basic design structure of a 3D model. The traditional two-dimensional views and drawings can be created by appropriate rotation of the object and selection of hidden line removal via cutting planes. This technique has some advantages, as follows: normally the 3-dimensional solid objects are complex, but wireframe model can be displayed in 1 dimension, improving comprehensibility; this solid object can be modified further; the designer can may or may not be ignore the geometry inside a surface while in solid modelling designer has to give consistent geometry for all detail. A wireframe shows the basic skeletal outline of the components of a object. Wired frames can be found by using different softwares that are available in the market."[3] AutoQ3D Community" is a software to create the wired frame of the object .Now we can use Bezier Curve and surface algorithm.

We can use[8] Bezier Curves algorithm to convert the Spherical surface to the Polygon. Now we find the boarder of the polygon using polygon Boundary filling algorithm. [5]Bezier surface is formed as the Cartesian Product of Bezier Blending functions.

$$P(u,v)=\sum_{J=0}^{m}\sum_{k=0}^{n} BEZ_{J,M}(v)\, BEZ_{K,N}(u)$$

Bezier surface have the same properties as Bezier curves ,and they provide a convenient method for interactive design applications .For each surface patch ,we can select a mesh of control points in the xy "ground" plane ,then we can chose elevations above the ground plane for the z-coordinate values of the control points. Patches can then be pieced together using the boundary constraints

IX. FUTURE ENHANCEMENTS

There is wide scope for research to find suitable algorithm to convert 3-d surface interface to a 2-d surface interface. It will be advantages if 3-d non flat interface implements bidirectional gesture interactions .Wide scope for research to establish boundary for each user so that multiuser environment becomes more user-friendly

X. CONCLUSIONS

In this paper, I presented an overview of comparative study of Flat and Non Flat interface. I summarized the various characteristics such as gesture identification, border identification . E.t.c.I strongly believe that most displays will soon be bi-directional, i.e., they will display images to the user and also sense the user's actions on their surface and as such provide interesting gestural interaction opportunities. With this comparative study we can see that Non Flat interface tends to be more expensive, unavailable hard to implement and so on. Flat surface interface are much more relevant and available now a day's .through future research and enhancements Non Flat interfaces can be brought to real life applications

REFERENCES

[1] computer graphics c version by Donald Hearn and M.Pauline Baker second edition
[2] Shen, C., Vernier, F., Forlines, C. and Ringel, M. (2004). DiamondSpin: An Extensible Toolkit for Around-the-Table Interaction. In *Proceedings of ACM Conference on Human Factors in Computing Systems (CHI).* p. 167–174
[3] http://vgc.poly.edu/~csilva/papers/tvcg2003acr.pdf
[4] http://research.microsoft.com/pubs/166553/athome.pdf
[5] http://link.springer.com/chapter/10.1007/978-3-642-03658-3_31#page-2
[6] http://surfacecomputing.com/information
[7] http://books/surfacecomputing
[8] http://www.hongkiat.com/blog/25-free-3d-modelling-applications-you-should-notmiss
[9] http://en.wikipedia.org/wiki/Wire-frame_model
[10] http://www.ieee.ca/canrev/cr62/IEEECanadianReview_no6 2L.pdf