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A Review on IDS (Interactive Display on Any Surface) and Various Business Applications

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Abstract-The growth in Human computer interaction technology progress towards the next generation as Natural User Interface from Graphical User Interface. Surrounded by the different modes of natural interaction one of the new emerging interactive methodology called Interactive Display on any Surface (IDS). An IDS is converting any surface as a touch screen. It makes the surfaces such as wall, table, and notebook, human body, etc. as interactive touch screen. These upcoming IDS will replace the traditional desktop monitors, Big LCD screens, laptops, projectors, whiteboards, digital boards, various smart phones having small screens and buttons with any environment as interactive touch screen. Moreover there is no need of separate input and output devices to interact with the system. Secondly it makes the business applications to improve towards the next level and making existence more comfortable. By means different modes of natural interaction it provide the better user experience. The Projection based marketing is the trend for every retail business from small showroom to big malls and restaurants. This innovative creation is playing its major role in various consumers and business environments .This paper discusses the working of IDS and some technologies. This paper in addition provides information's regarding the scenarios where the usage of these IDS in various business applications.
Keywords: IDS (Interactive Display on Any Surface), HCI (Human Computer Interaction), NUI (Natural User Interface), Touch Screens, Applications.

I. INTRODUCTION

Human Computer Interaction is a discipline anxious about the study, design, and planning of interaction between the user and computing systems [5]. The interaction between computer and user is done by a communication medium called UI (User Interface) [4]. In HCI, User Interface is an important component which decides the designed program is user friendly or not. People could always need for fantastic user experience in various fields. And so Computer-user interface has progressed from CLI (Command Line Interface) to GUI (Graphical User Interface). Even nowadays people are using a new enhanced version of GUI with various features. Since from the first generations of HCI still at the present there is a vast difference and changes in the interaction styles and UI designs. Yet we are experiencing various and sustaining UI, still our vision is expecting something with creativeness and innovative. And researchers are trying very hard to push the human computer interaction towards next level by making it very close to the natural human behavior.

This type of intuitive interface is referred as Natural User Interface, where the user does not need any prior knowledge or experience to have a seamless interaction. The Graphical User Interface with its flexible representations and real-world outputs combined with touch capabilities can be used in performing more complex interactions provided the user has some expertise on the system. But using the Natural Language Interface any user could easily transform from a novice to expert, as it is performed with intuitive actions related to natural, everyday human behavior.[3]Over the past few years there have been a serious discussion in defining the term Natural User interface. The term NUI is defined in [1] is based on the qualities like Directness, Naturalness and Computer Input and Output. In [2] it is described as interact directly with the content by reusing the existing skills. It is also suggested in [3], NUI should create an experience like extension of their body for experts and very natural for novice users respectively. Finally in this paper we have defined NUI as, it is aiming to provide more intuitive and natural experience by using the natural interaction approaches of humans.

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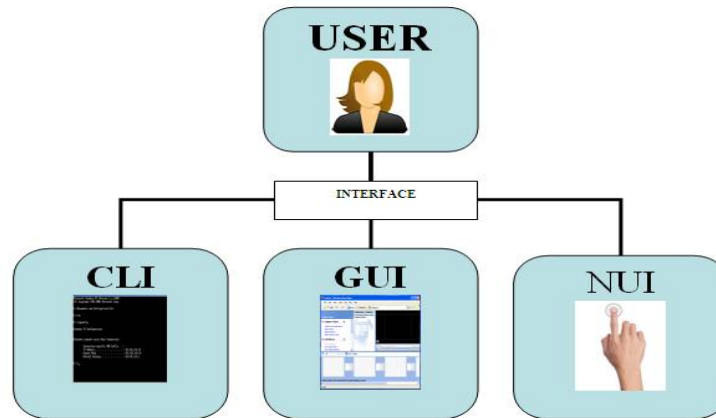

Figure1.1 Three generations of HCI

The interaction style of NUI works without the traditional external devices like mouse, keyboard, and joysticks even without monitors. NUI includes different modes of interaction styles like face, hands, and voice and body movement. Based on the different modes of interaction style there are some possible methods to experience the NUI. They are touch based, gesture based, voice based and others. These various methods of interaction have reached some extreme points in various applications in the recent times. Moreover the advancement in sensors, cameras, and miniaturization of consumer electronic technology has the ability to have interaction on any surface more naturally without separate I/O devices. Nowadays it plays the role in various applications to have interesting user experience. In this paper we sketched what is IDS, provides the usage of IDS in various business environments. Ask that authors follow some simple guidelines. In essence, we ask you to make your paper look exactly like this document. The easiest way to do this is simply to download the template, and replace the content with your own material.

II. IDS IN VARIOUS BUSINESS APPLICATIONS

For every successful business we must ensure the excellent user experience. Technologies are used to attract and spot the customers they are providing a pleasant user experience while reducing the manpower requirements. In that case the IDS is deployed in various business needs in diverse domains. It makes the business applications more interactive, catchy innovative and provides a new way to find the customers quickly and efficiently. The IDS with different modes of interaction are deployed in

A. Retail stores

The IDS on wall/table can be kept in various sections or in the common area of the retail store. The customers could use this new way of User interface to browse through the catalogue and place the order for trial or billing. This new way of interaction provides pleasant experience for customers while reducing the manpower requirements for the retails store. It could also be project on window of any shop, so that it could turn a passerby into a customer and attracts them with different user experience.

B. Restaurants

The IDS converts the dining tables at restaurants as interactive table. The customers can use the interactive dining table to browse through the menu and place the order. In the mean while the interactive dining table could provide access to Internet, Social networks, games and making their dining experience pleasant. This will provide interesting experience for kids.

C. Health Care

This Healthcare industry is continuously exploring new ways of utilizing technology for advanced clinical requirements and improved efficiency. Interactive screen would be useful in various scenarios of health care units. Right from the hospital reception, doctor's room and even operation theatres. In the hospital reception, the incoming patients can interact with this system on any wall to find out the hospital information. This would give better user experience and provide effective space utilization. In operation theatres, doctors may have to refer the diagnosis report and many other patient details during the surgery. Typically the computers and hardcopy of the reports would be used by doctors at the operation theatre. While referring these documents or computers doctors may have to move out of the current position. This might deviate their attention and may not be comfortable. Having IDS is

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easily accessible from doctor's position would help the doctors not to deviate from their position during Surgery.

D.   Gaming & Entertainment

The applications in Gaming and Entertainment need to be more intuitive and natural to succeed in the industry. Interactive display on any surface provides great user experience of games and entertainment application. This also provides flexibility to use the gaming applications anywhere. Kids will find this style and flexibility of interaction in playing games very interesting. This will naturally have short learning curve for kids. Using this we can a small handheld devices into a big screen for watching movies. It would also be common to see people using this interaction style for games and other entertainment applications. Games like table tennis, chess, football and other games could be more intuitive playing using IDS.

E.   Factories / Construction Site / Any Manufacturing facility

In general using computers in the factories where heavy machineries are deployed and construction sites may not be feasible due to space constraints and working conditions. Having the IDS will enable the computer applications to be used in those facilities with minimal difficulties as what is needed is any surface with sufficient lighting. While this provides flexibility of using computer applications this would increase the productivity of the work.

F.   Garment industries

Generally designers in the garments industry predominately do the practical design and computer aided design separately. This system will provide the computer aided design software tool is projected as Interactive screen on the Designer workbench itself. Even in large garment companies where regular data updates and interaction is needed from the workers on regular basis, having interactive display on the workers table would be useful. Hence it will enhance the User experience and productivity through Interactive projector.

III. IDS AND ITS WORKING

Unlike usual touch screen a fascinating mode of NUI called Interactive Display on Surface is getting drive in recent trends. Due to advancements in sensor, cameras and projected light technologies it turns any surface into interactive screen .This technology has the potential to take the human computer interaction to the next level. It makes surfaces such as wall, table, hand, notebook, any surface as interactive screen. This interactive projector includes both the computer free features and computerised features. We interact with the system by using different modes of interaction like remote, interactive pen, stylus, touch, gesture, voice. These above mentioned modes of interaction varies depends upon the various technologies. Why IDS? Since we use solid base input and output interfaces to interact, whereas IDS don't need any separate hardware input and output devices. It also addresses the limitation in various aspects from the traditional desktop, laptops, projectors, whiteboards, digital boards, various smart phones, touch screens having small screens and buttons. The added advantage is the displayed area is vacant when it is not in use, we can use it for supplementary use [7]. Moreover it is very difficult to outlook, access and exhibit the large amount of data with the small embedded screens. The enhancement of many applications in handheld devices, the small screens and the interaction space makes user experience very poor. These limitations are overcome by recent advancement in technology .This projection helps to expand or reduce the size of the screen. It makes the applications more interactive and provides a new way for users to find information quickly and efficiently.

A.   Working of IDS

The Figure 1.2 shows the working of IDS, which includes two main steps i) Display the screen on any surface ii) Interaction tracking.

1)   *Display the screen on any surface:* There are so many projection technologies to display the screen on any surface. Laser based projector display the image pixels by pixel in sequence through routing laser beams [8]. Another type of projection is done by diffraction through hologram patterns [8].

2)   *Interaction Tracking:* Infrared sensor technology tracks the stylus, finger will allow us to control and interact with the screen which is projected. There is an infrared camera which captures the interaction signal which in turn converted into touch screen co-ordinates by an image processor [10]. Another type of tracking device is depth sensor camera will calculate the range in triangulating pattern of the image [9]. It will detect the interaction on the screen.

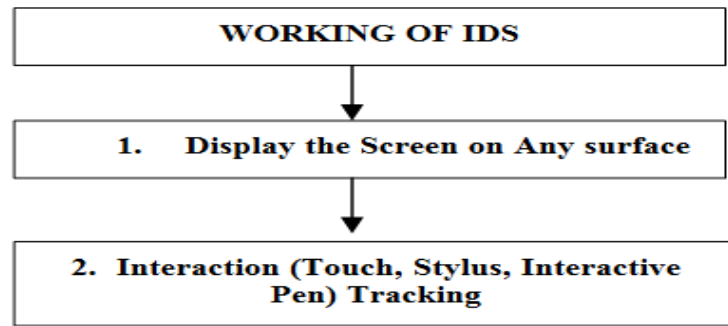# International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Figure1.2 Working of IDS

B.   Various Technologies of IDS

Various technologies have been introduced to develop Interactive Display on any surface devices. IDS can be classified into many types based on various categories. They are

1)   Wearable devices and Non wearable devices
2)   Mobile and handheld devices (Miniaturization)
3)   Standalone devices
4)   Sensor based devices
5)   Depth Sensing Camera based devices
6)   Holographic based devices
7)   Interactive Display on wall/floor/table and glass
8)   Interaction style – single & multitouch based, gesture based, stylus based

IV. RELATED WORKS

In [14] Omni Touch draws from a variety of fields, including touch interaction techniques, surface computing, free-space gesturing, computer vision, wearable, and ubiquitous computing. It is a wearable depth-sensing and projection system that enables interactive multitouch applications on everyday surfaces. Beyond the shoulder-worn system, there is no instrumentation of the user or environment. Foremost, the system allows the wearer to use their hands, arms and legs as graphical, interactive surfaces. Users can also transiently appropriate surfaces from the environment to expand the interactive area (e.g., books, walls, tables)[14]. The Figure 1.3 shows the wearable depth sensing projection system on any surface device called Omni touch [14].
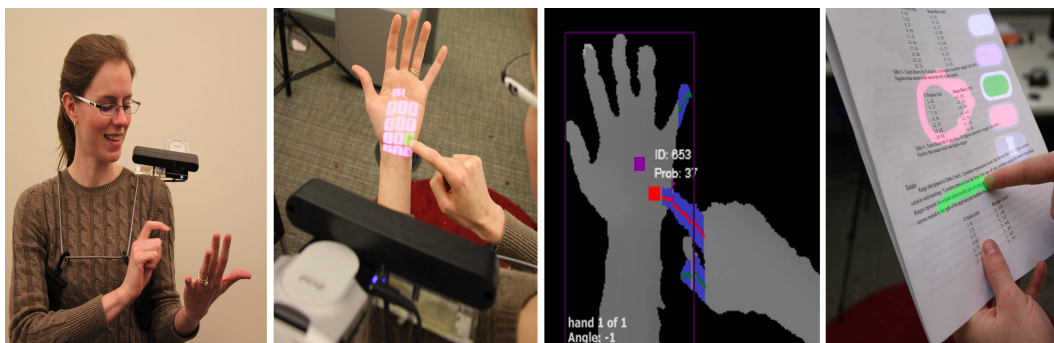

Figure1.3 Omni Touch is a wearable depth-sensing and projection system that allows everyday surfaces – including a wearer's own body - to be appropriated for graphical multi touch interaction (image from [14]).

As a promising new technology that has the potential to become prevalent in the near future, handheld projectors open up an emerging research area on how people may perform interactions using them was discussed in [8] . The new input/output affordances and the possible mobile usage scenarios enabled by handheld projectors, traditional techniques designed for desktop computer interaction are unlikely to suit them also given in [8] . And also [8] stated the new paradigms and techniques need to be designed and evaluated to support handheld projector interaction, both for a single user and for multiple users located in the same

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physical environment.

Figure1.4 Flashlight Experience (Fig from [8])

A comprehensive study about the projector camera system was given in [7]. Ammer Andreas have sketched the clear implementation about the projector camera system. In [7] the application was splitted into two parts, one part controlling the projections and one part handles the image processing, called these two parts Projection Controller (PC) and Camera Image Processing (CIP). The advantage of a projector is that the image can be displayed in a number of different location and sizes.
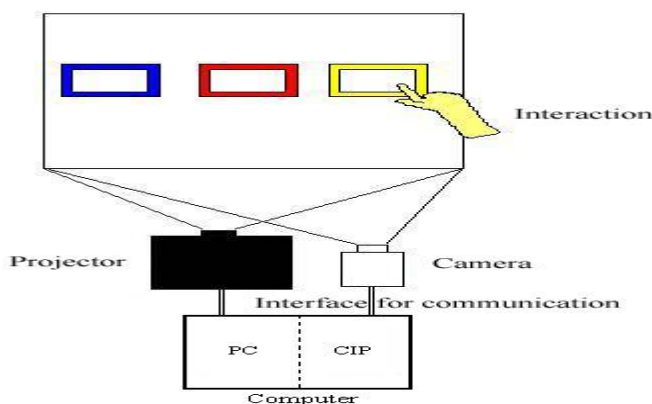

Figure1.5 Layout of Projector camera system (figure from [7]

The display technology in [26] called Holographic Laser Projection is a revolution. The term holographic refers to the creative technique which is used to create 2D images. Using holographic algorithms, the image which we want to project transform into sets of diffraction patterns, which are shown on a tiny micro display. When laser light illuminate the micro display, the projected image is formed by diffraction. Diffraction patterns are highly efficient. Instead of blocking light, they wrestle light to exactly where it is needed and away from where it is not. Calculating the diffraction pattern for each high quality image would be too computationally serious, as a result more elegant solution is created. The multiple patterns are calculated, each of which forms a rough edition of the image. When viewed in quick sequence, the eye evens away the noise and perceives a single, visibly clear image. So the efficient, high quality video in real time is obtained. Using lasers means colours emerge rich and vibrant, and the image is always in focus. HLP™ technology also projects flawlessly onto curved surfaces. Its uniquely wide throw angle creates large images very close to the projector. These features enable us to integrate infrared sensing technology and create an interactive projector that instantly transforms any flat surface into a touch screen [26].

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Holographic Laser Projection (HLP™) is quite unlike any other method of projection. It delivers a unique portfolio of features and benefits and opens up new opportunities for bright, high quality, efficient projected displays.
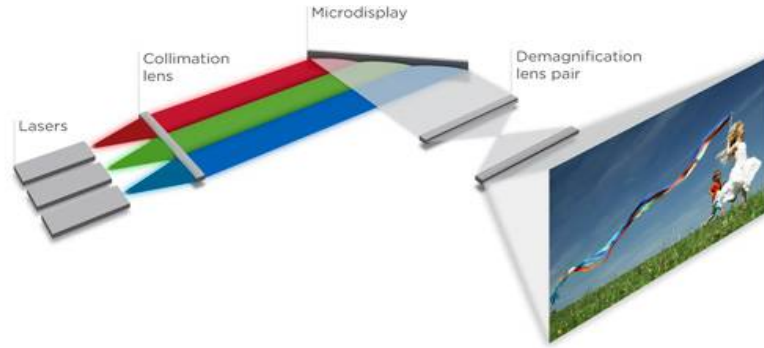
Figure1.6 Holographic Laser projection (Fig from [26])

The comparison of various IDS device is given in table 1. In that table we have present the device falls on which category, type of technology used, Interaction Style and projection surface.

TABLE 1 COMPARATIVE TABLE FOR VARIOUS IDS DEVICES

S.NO	Device	Type	Technology		Interaction style	Projection surface	Reference
			Projector Type	Interaction detector			
1	Light Touch	Compact	Holographic Projector	Infrared sensor	Touch	Any Flat surface	[16]
2	Omni Touch	Wearable	Pico Projector	Depth sensing camera	Multi Touch	Any Surface	[14]
3	Pocket Projector	Compact & handheld	Pico Projector	Infrared Sensor	Touch	Any flat surface	[11]
4	Bright Link Interactive Projector	Stand alone	Laser Projector	Infrared Sensor	Touch & Dual Pen	Wall	[12]
5	Touch jet Pond	Handheld Projector	Tiny Projector	Infrared Sensor	Infrared Pen	Any flat surface	[10]
6	Cicret Bracelet	Wearable	Pico Projectors	Infrared Sensor	Touch	Skin	[13]
7	Worldkit	Stand alone	Ordinary Projector	Depth Sensing Camera	Touch & Gesture	Any Flat Surface	[15]

V. CONCLUSION

We attempted to convey a short picture of the importance of IDS as it has been emerged from Human Computer Interaction. This paper summarizes some new lessons and research   directions to the IDS design beginners. There are numerous scenarios where Natural interactions can apply in industries such as Retail, Advertisements, Entertainments and others. This paper was trying to highlight the different scenarios and feasibility of applying the IDS with different NUI modes in some of the industries were discussed in this paper. We have presented the comparison of various IDS. The Table contains the following details like which device falls on which category, type of technology used, Interaction Style and projection surface. Further advancements in hardware and

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software technologies will bring more Natural Interfaces in the applications and gradually NUI will become common interaction style resembling human to human interaction.

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