A Survey on A Study on Wearable Gestural Interface

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ABSTRACT

In this note, we present SixthSense, a wearable gestural interface that augments the physical world around us with digital information and lets us use natural hand gestures to interact with that information. By using a tiny projector and a camera coupled in a pendant like mobile wearable device, SixthSense sees what the user sees and visually augments surfaces, walls or physical objects the user is interacting with; turning them into just-in-time information interfaces. SixthSense attempts to free information from its confines by seamlessly integrating it with the physical world.

*Information is traditionally confined to paper or digitally to a screen. In this paper, we introduce WUW(**WUW - Wear Ur World**), a wearable gestural interface, which attempts to bring information out into the tangible world. By using a tiny projector and a camera mounted on a hat or coupled in a pendant like wearable device, WUW sees what the user sees and visually augments surfaces or physical objects the user is interacting with. WUW projects information onto surfaces, walls, and physical objects around us, and lets the user interact with the project information through natural hand gestures, arm movements, or interaction with the object itself.*

Keyword: *Gestural Interaction   , Augmented Reality, Wearable Interface, Tangible Computing, Object Augmentation, WUW - Wear Ur World.*

1. INTRODUCTION

We humans have five natural Senses which we use to interact with the surrounding environment or the physical world and perceive information, this information helps us to make decisions and take the right actions. But arguably the most useful information that can help us make the right decision is not naturally perceivable with our five senses, namely the data, information and knowledge that mankind has accumulated about everything and which is increasingly all available online. The Sixth Sense is wearable gestural interface which bridges the digital world with simple gestures. The first Sixth Sense device was developed by Pranav Mistry at MIT media lab. Sixth Sense in scientific terms is defined as ESP (Extra Sensory Perception). ESP includes the information that is not gained through our natural Senses. Sixth Sense aims to integrate online information and technologies into everyday life. So it can help the human to make decision effectively. Many hand gesture controlled techniques have been developed based on image processing.

This 'Sixth Sense' is a wearable gestural interface that augments the physical world around us with digital information and lets us use natural hand gestures to interact with that information. Although the reducing size of computing devices allows us to carry computers in our pockets, keeping us continuously connected with the digital world. There exist no intermediate link between our digital devices and our interactions with the physical world. Information is confined traditionally on paper or digitally on a screen. Sixth Sense Device binds this gap, bringing intangible, digital information out into the tangible world, and allowing us to interact with this information via natural hand gestures. 'Sixth Sense' frees information from its confines by seamlessly integrating it with reality, and thus making the entire world your computer. Sixth Sense allows people to use internet without a screen or a

keyboard it actually acts itself as a computer and is connected to cloud. It has turned any surface into a touch screen. By using a camera and a tiny projector mounted in a pendent like wearable device. 'Sixth Sense' sees what you see and visually augments any surface or objects we are interacting with. It projects information onto surfaces, walls and physical objects around us, and let us interacts with the projected information through natural hand gestures, arm movements, or our interaction with the object itself. The software program processes the video stream data captured by the camera and tracks the locations of the colored markers (that we wear on our fingers) using simple computer vision techniques. This paper helps us have knowledge of how the sixth sense device had vanquished the five natural senses. This paper makes us cognizant how the sixth sense technology provides an integration of the digital world with the real world. This paper focuses over various applications light over various security related issues and further implications. The theory behind Sixth Sense Technology is that the Sixth Sense Device tries to determine not only what someone is interacting with but also how he or she is interacting with it. The software searches the internet for the information that is relevant to that situation.

2. RELATED WORK

Recently, there has been a great variety of multi-touch interaction based tabletop and mobile device (e.g.[2]) products or research prototypes that have made it possible to directly manipulate user interface components using touch and natural hand gestures. Several systems have been developed in the multi-touch computing domain [4], and a large variety of configurations of sensing mechanisms and surfaces have been studied and experimented within this context. The most common of these include using specially designed surfaces with embedded sensors (e.g. using capacitive sensing [5, 16]), cameras mounted behind a custom surface (e.g. [10, 22]), cameras mounted in front of the surface or on the surface periphery (e.g. [1, 7, 9, 21]). Most of these systems depend on the physical touch-based interaction between the user's fingers and physical screen [4] and thus do not recognize and incorporate touch independent freehand gestures.

Oblong's g-speak [12] is a novel touch-independent interactive computing platform that supports a wide variety of freehand gestures to a very precise accuracy. Initial investigations, though sparse due to the availability and prohibitive expense of such systems, nonetheless reveal exciting potential for novel gestural interaction techniques - that conventional multi-touch tabletop and mobile platforms do not provide. Unfortunately, g-speak uses an array of 10 high-precision IR cameras, multiple projectors, and an expensive hardware setup that requires calibration. There are a few research prototypes (e.g. [8, 10]) that can track freehand gestures regardless of touch, but they also share some of the same limitations as most multi-touch based systems: user interaction is required for calibration, the hardware is at reach from the users, and the device has to be as large as the interactive surface, which limits its portability; nor does it project on a variety of surfaces or physical objects. It should also be noted that most of these research prototypes rely on custom hardware and that reproducing them represents a non-trivial effort.

WUW also relates to augmented reality research [3] where digital information is superimposed on the user's view of a scene. However, it differs in several significant ways: First, WUW allows the user to interact with the projected information using hand gestures. Second, the information is projected onto the objects and surfaces themselves, rather than onto glasses or goggles, which results in a very different user experience. Moreover, the user does not need to wear special glasses (and in the pendant version of WUW the user's entire head is unconstrained). Simple computer-vision based freehand-gesture recognition techniques such as, wearable computing research projects and object augmentation research projects such as inspires the WUW prototype.

3. DIFFERENT COMPONENTS WHICH REQIURED IN PROPOSED SYSTEM

There are five components we are going to use

1. Camera
2. Projector
3. Mirror
4. Mobile Component
5. Colored Markers

1. CAMERA

- ➢ Camera Captures an object in view and tracks the user's hand gestures.
- ➢ It acts as a digital eye.
- ➢ Key input device, serving as a digital eye of SixthSense system

2 . PROJECTOR

- ➢ The projector projects the visual information enabling surfaces and physical objects to be used as interfaces
- ➢ Key output device that usually augment surfaces, walls and physical objects that user is interacting with.

3. Mirror

> ➤ The usage of mirror is significant as the projector dangles pointing downwards from the neck
> ➤ Reflect the projection from the projector onto the desired location on walls or surfaces ,any 1"x1" fine surface mirror can be useful

4. Mobile

> ➤ A web enabled smart phone in the user's pocket processes the video data
> ➤ It is the processor of the SixthSense system. The Gesture Recognisation software runs on this device which can either be a laptop or a mobile phone. The device can be connected with other component through a wired or wireless connection

5. Coloured markers

> ➤ It is at the tip of user's fingers

➢ Marking the user's fingers with red, yellow, green and blue tapes helps the web cam recognizes the gestures
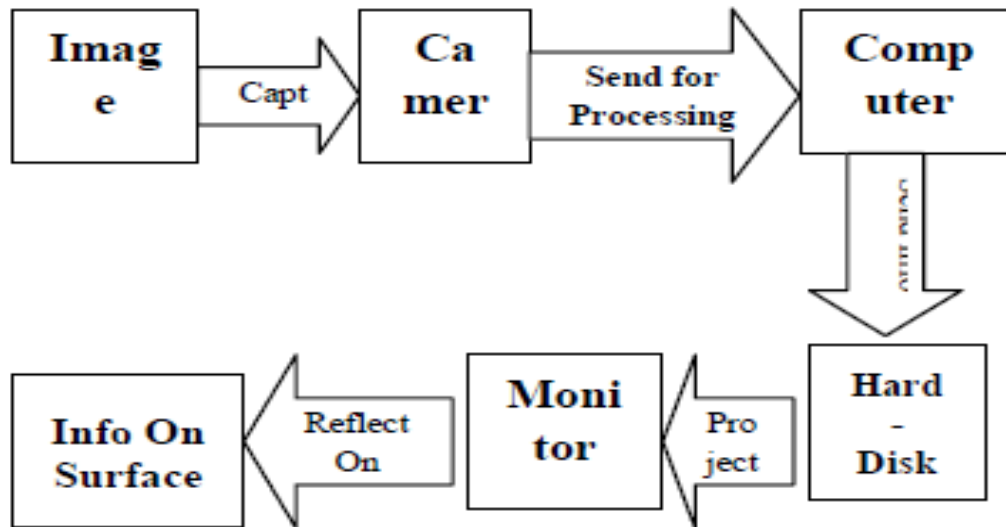
5. HOW IT WORKS ?

Fig-1: **Working of Sixth Sense**

As depicted in Figure 1, *SixthSense* prototype consists of three main components: A pocket projector, Mirror and Camera [1]. The interface employs colored fingertips as markers. The prototype model of this device is currently available with four colors: Red, Green, Blue and Yellow. Most of the applications are executed using the four basic colors. The Sixth Sense prototype consists of a Camera, Projector, Mirror, Coloured caps and Smart phone (or laptop/desktop). The Camera acts as digital eye for the device. The projector helps in projecting on to a particular surface with the help of the mirror. Colored caps are used as markers which are used in color recognition. The Camera captures the gestures made in front of it and it is processed as binary images by the Smart Phone with the help of numerous complex algorithms and the relevant information related to the gesture is projected by the projector on any interface. For example if you do a Namaste gesture (a spiritual way of greeting in India) in front of the Camera, application menu is opened and we can select a particular application by hand click gesture [11]. You can take pictures by simply enacting a gesture of clicking the picture. As the code is Open Source we can make changes to the device and make it work on a variety of different gestures and not just the original ones.

5. ADVANTAGES

1. Portable
2. Supports multi touch and multi user interaction
3. Connects the digital world and physical world
4. Effective cost
5. Data access directly from the machine in real time
6. Map the idea anywhere
7. It is an open source

6. APPLICATIONS

1. MAKE A CALL
2. CALL UP A MAP

3. CHECK THE TIME
4. VIDEOS ON NEWS PAPERS
5. DRAWING APPLICATION

7. MATHMATICAL MODEL

7.1 MATHEMATICAL MODULE

Set Theory

1   Set Theory Analysis

   1   Let 'S' be the "Image"
       S= {…………….}
       Set S is divided into 2 modules
       S= {S1, S2}
       S1= Image Capture by camera.
       S2= Image Send For processing.

   2   Identify the inputs.
       For S1

Inputs = {X1}

       X1= Capture Image

   3   Identify the output for S1.

       Outputs = {Y1}

       Y1= Provide Image for next process.

   4   Identify the inputs.
       For S2

       Inputs = {X2, X3}

       X2=For next process image send to the computer.

       X3=Hard disk Check this image.

   5   Identify the output for S2.

       Outputs = {Y2, Y3}

       Y2= computer and hard disk integrate the image

       Y3= Provide Reflection on surface.

7.2 Venn Diagrams :-

Let M be the Mathematical Model which Consists Of Captured Image, Hard Disk, reflection on surface

M= {I,H,S};

I= {Image}

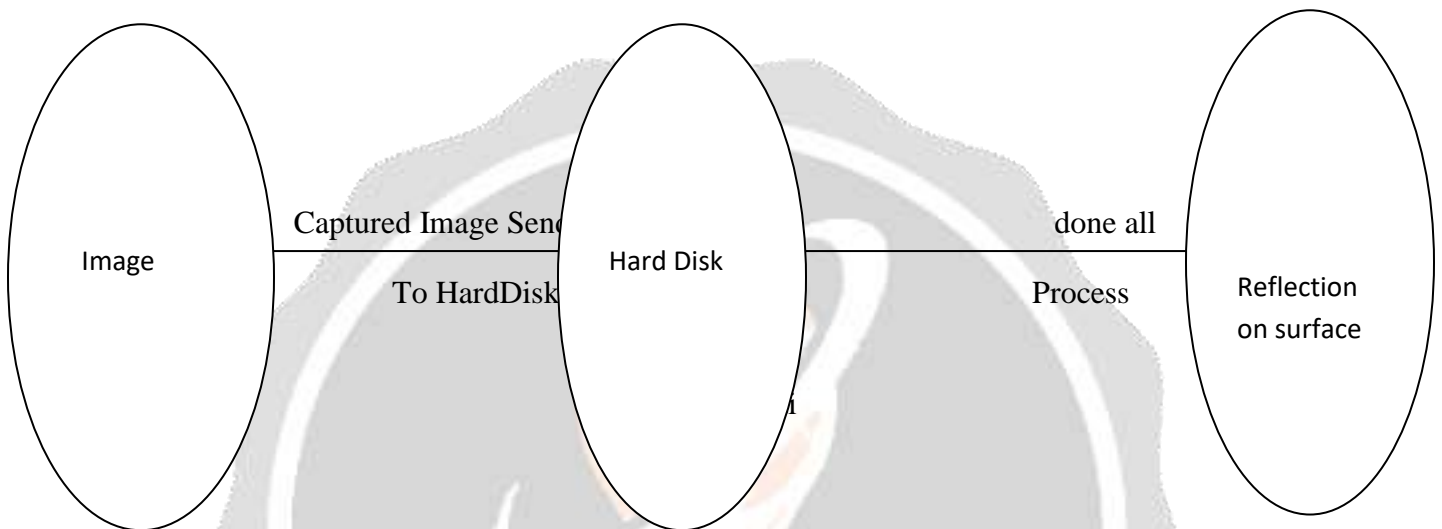H={Hard Disk}

S={Reflection of image}

Fig-2:Ven diagram

o   The hardware that makes sixth sense work is a pendant like mobile wearable device.

o   It has a camera, a projector, a mirror and is connected wirelessly to Bluetooth smart phone that can slip comfortably into one's pocket.

o   The camera recognizes individuals, images, pictures, gestures one makes with their hands.

o   Information is sent to the Smartphone for processing.

o   The downward-facing projector projects the output image on to the mirror.

o   Mirror reflects image on to the desired surface.

o   Thus digital information is freed from its confines and placed in the physical world.

8. FLOWCHART
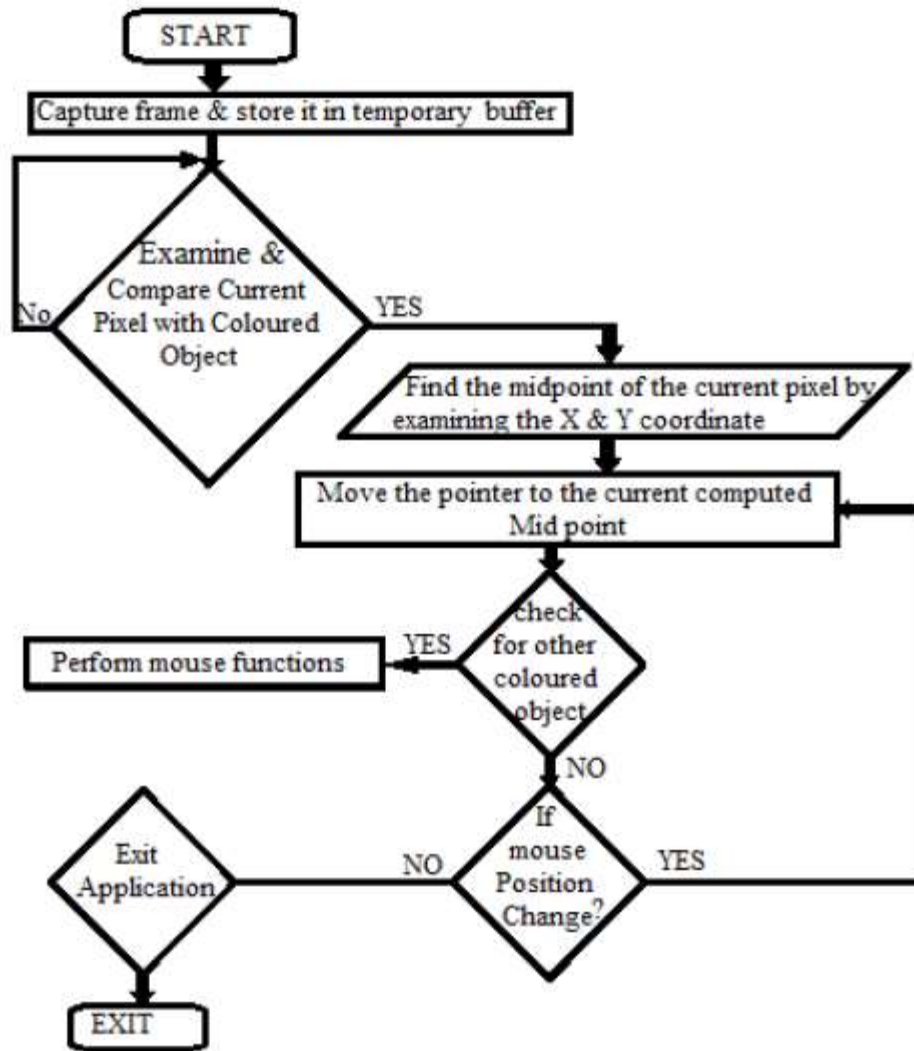
9. FUTURE ENHANCEMENTS

1. To get rid of color markers.
2. To incorporate camera and projector inside mobile computing device.
3. To have 3D gesture tracking.
4. To make Sixth Sense work as fifth Sense for disabled person.

10. CONCLUSIONS

Sixth sense recognizes the objects around us, displaying information automatically and letting us to access it in any way we need.In simple, it is almost like installing a digital system (computer) into our body and further making it as sixth sense of our body The sixth sense prototype implements several applications that demonstrate the usefulness, viability and flexibility of the system. Allowing us to interact with the information via natural hand gestures.

11. ACKNOWLEDGEMENT

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