THE SIXTH SENSE TECHNOLOGY

Mandar Ghate

Department Of Computers, Padmabhushan Vasantdada Patil Pratisthans College Of Engineering, Mumbai.

mandarghate4@gmail.com
Contact no. 8082495498/9029019950.

Abstract— 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. Steve Mann is considered as the father of Sixth Sense Technology who made wearable computer in 1990. He implemented the Sixth Sense Technology as the neck worn projector with a camera system (which Mann originally referred to as "**Synthetic Synesthesia of the Sixth Sense**"). He was a media lab student at that time. Then his work was carried forward by Pranav Mistry (Ph.D student in the Fluid Interfaces Group at the MIT Media Lab). By using a camera and a tiny projector, Sixth Sense sees what you see and visually augments any surfaces or objects we are interacting with. It projects information onto surfaces, walls and physical objects around us, and lets us interact with the projected information through natural hand gestures, arm movements, or our interaction with the object itself. This wearable gestural interface attempts to free information from its confines by seamlessly integrating it with reality, and thus making the entire world your computer. To a layman, it would be something supernatural. Some might just consider it as a superstition or something psychological. But the invention of Sixth Sense Technology has completely shocked the world. Although it is not widely known as of now but the time is not far when this technology will change our perception of the world.

INTRODUCTION

We've evolved over millions of years to sense the world around us. When we encounter something, someone or some place, we use our five natural senses to perceive information about it; that information helps us make decisions and chose the right actions to take. 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. Although the miniaturization of computing devices allows us to carry computers in our pockets, keeping us continually connected to the digital world, there is no 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 bridges 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 Technology is the newest jargon that has proclaimed its presence in the technical arena. This technology has emerged, which has its relation to the power of these six senses. Our ordinary computers will soon be able to sense the different feelings accumulated in the surroundings and it is all a gift of the "Sixth Sense Technology" newly introduced. Sixth Sense will allow us to interact with our world like never before. We can get information on anything we want from anywhere within a few moments! We will not only be able to interact with things on a whole new level but also with the people! One great part of the device is its ability to scan objects or even people and project out information regarding what you are looking at.

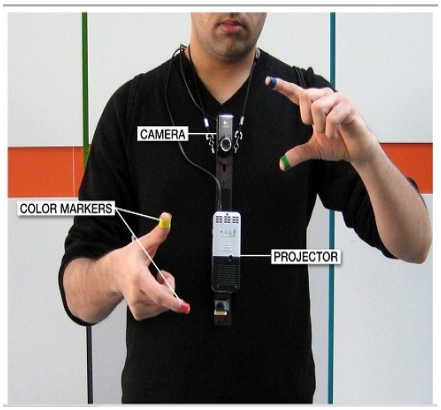
Sixth Sense Technology is a perception of augmented reality concept. Sixth Sense is in fact, about comprehending information more than our available senses. And today there is not just this physical world from where we get information but also the digital world which has become a part of our life. This digital world is now as important to us as this physical world. And with the internet the digital world can be expanded many times the physical world. God hasn't given us sense to interact with the digital world so we have created them like smartphones, tablets, computers, laptops, net books and other gadgets. These gadgets enable us to communicate with the digital world around us.

But we are humans and our physical body isn't meant for digital world so we can't interact directly to the digital world. For instance we press keys to dial a number; we type text to search it and so on. This means for an individual to communicate with the digital world he/she must learn it. We don't communicate directly and efficiently to the digital world as we do with the real world. The Sixth Sense Technology is all about interacting to the digital world in most efficiency and direct world.

COMPONENTS

The devices which are used in Sixth Sense Technology are:

1. Camera.
2. Coloured Marker.
3. Mobile Component.
4. Projector.
5. Mirror.



1.Camera:
It captures the image of the object in view and tracks the user's hand gesture. The camera recognizes individuals, images, pictures, gestures that user makes with his hand. The camera then sends this

data to a smartphone for processing. Basically the camera forms a digital eye which connects to the world of digital information.

2. Coloured Marker:

There are colour markers placed at the tip of users fingers. Marking the user's fingers with red, yellow, green and blue coloured tape helps the webcam to recognize the hand gestures. The movements and arrangement of these markers are interpreted into gestures that act as a interaction instruction for the projected application interfaces.

3. Mobile Component:

The Sixth Sense device consists of a web enabled smartphone which process the data send by the camera. The smartphone searches the web and interprets the hand gestures with the help of the coloured markers placed at the finger tips. Basic processing works on computer vision algorithms where approx. 50,000 lines of code are used written in Symbian C++.

4. Projector:

The information that is interpreted through the smartphone can be projected into any surface. The projector projects the visual information enabling surfaces and physical objects to be used as interfaces. The projector itself consists of a battery which have 3 hours of battery life. A Tiny LED projector displays the data sent from the smartphone on any surface in view-object, wall or person. The downward facing projector projects the image on to a mirror.

5. Mirror:

The usage of a mirror is important as the projector dangles pointing downward from the neck. The mirror reflects the image on to a desire surface. Thus finally the digital image is freed from its confines and placed in the physical world.

KINDS OF GESTURES RECOGNIZED

The software recognizes three kinds of gestures:

1.Multi-Touch Gestures:

Like the ones we see in the iphone-where we touch the screen and make the map move by pinching and dragging.

2. Freehand Gestures:

Like when you take a picture or Namaste gesture to start the projection on the wall.

3. Iconic Gestures:

Drawing an icon in the air. Like, whenever we draw a star, shows us the weather details. When we draw a magnifying glass, shows us the map.

WORKING

The Sixth Sense Technology works as follows:

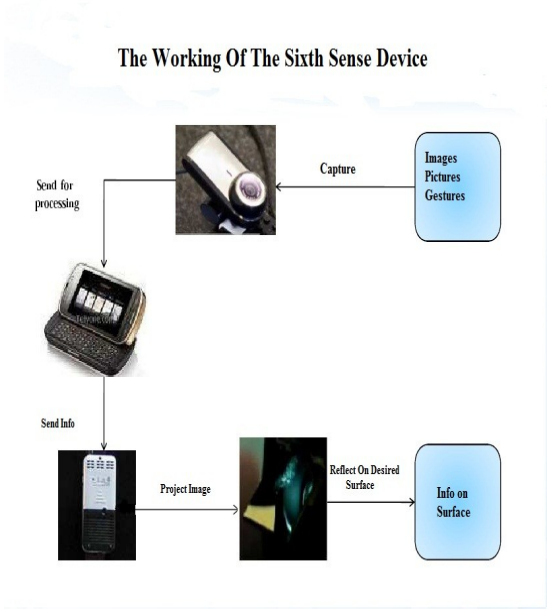
1.It captures the image of the object in view and track the user's hand gestures.

2. There are colour markers placed at the tip of users finger. Marking the user's fingers with red, yellow, green and blue coloured tape helps the webcam to recognize the hand gestures. The movements and arrrangement of these markers are interpreted into gestures that act as a interaction instruction for the projected application interfaces.

3. The smartphone searches the web and interprets the hand gestures with the help of the coloured markers placed at the finger tips.

4. The information that is interpreted through the smartphone can be projected into any surface.

5. The mirror reflects the image on to a desired surface.

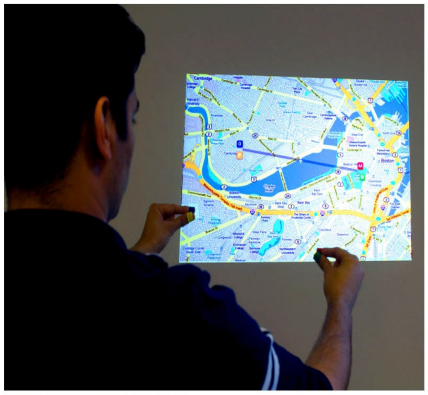


APPLICATIONS

The Sixth Sense Technology finds a lot of applications in the modern world. The Sixth Sense devices bridge the gap by bringing yhe digital world into the real world and in the process allowing the users to interact with the information without the help of any machine interfaces. Prototypes of the Sixth Sense device have demonstrated viability, usefulness and flexibility of this new technology. Acoording to the words of its developers the extend of use of this new device is only limited bythe imagination of human beings.Some practical apllications of the Sixth Sense Technology is given below:

1.Viewing Map:

With the help of a map application the user can call upon any map of his/her choice and navigate through them by projecting the map on to any surface. By using the thumb and index fingers movements the user can zoom in, zoom out or pan the selected map.



Using any surface as an interface (Photo credit: Sam Ogden)

2. Taking Pictures:

Another application of Sixth Sense devices is the implementation of a gestural camera. This camera takes the photo of the location user is

looking at by detecting the framing gesture. After taking the desired number of photos we can project them onto any surfaces and then use gestures to sort through those photos and organize and resize them.

3. Drawing Application:
The drawing application allows the user you to draw on any surface by tracking the fingertip movements of the user's index finger. The pictures that are drawn by the user can be stored and replaced on any other surface. The user can also shuffle through various pictures and drawing by using the hand gesture movements.

4. Making Calls:
We can make calls with the help of Sixth Sense device. The Sixth Sense device is used to protect the keyboard into your palm and using that virtual keypad we can make calls to anyone.

5. Interacting with physical objects:
The Sixth Sense system also helps to interact with physical objects we use in a better way. It augments physical objects by projecting more information about these objects projected on them. For example, a gesture of drawing a circle on the user's wrist projects an analog watch on the user's hand. Similarly a newspaper can show live video news or dyanamic information can be provided on a regular piece of paper.

6. Getting Information:
Sixth Sense devices can be used for getting various information relating to our everyday life by getting in contact with objects.

(a)Product information:
Sixth Sense Technology uses marker technology or image recognition techniques to recognize the objetcs we pick in our hand and then provide information realting to the product.

(b) Book Information:
By holding and shuffling through the book pages, the Sixth Sense provides Amazon ratings on that book, other reviews and other relevant things related to the book.

(c) Flight Updates:
With the help of the Sixth Sense Technology it is no longer required to log into any sites for checking the status of the flights. The system will recognize your boarding pass and let you know whether the flight is on time or not.

7. Sixth Sense also lets the user draw icons or symbols in the air using the movement of the index finger and recognizes those symbols as interaction instructions.
For example, drawing a magnifying glass symbol takes the user to the map application or drawing an '@' symbol lets the user check his mail.

ADVANTAGES

1.Portable:
One of the main advantages of the Sixth Sense devices is its small size and portability. It can be easily carried around without any difficulty. The prototype of the Sixth Sense is designed in such a way that it gives more importance to the portability factor. All the devices

are light in weight and the smartphone can easily fit into the user's pocket.

2. Support Multi touch and Multi user interaction:
Multi touch and Multi user interaction is another added feature of the Sixth Sense devices. Multi sensing techique allows the user to interact with system with more than one finger at a time. Sixth Sense devices also in-corporates Multi user functionality. This is typically useful for large interaction scenarios such as interactive table tops and walls.

3. Cost Effective:
The cost incurred for the construction of the Sixth Sense prototype is quite low. It was made from parts collected together from common devices. And a typical Sixth Sense device costs upto $300. The Sixth Sense devices have not been made in large scale for commercial purpose. Once that happens it's almost certain that the device will cost much lower than the current price.

4. Data access directly from the machines in real time:
With the help of a Sixth Sense device the user can easily access data from any machine at real time speed. The user doesn't require any machine-human interface to access the data. The data access through recognition of hand gestures is much easier and user friendlier compared to the text user interface or grapichal user interface which requires keyboard or mouse.

5. Mind map the idea anywhere:
With the advent of the Sixth Sense device, requirement of a platform or a screen to analyze and interpret the data has become obsolete. We can project the information onto any surface and can work and manage the data as per our convenience.

6. Open Source Software:
The software that is used to interpret and analysis the data collected by the device is going to be made open source as said by its inventor. This will enable other developers to contribute to the development of the system.

CONCERNS

There is a health issue regarding Sixth Sense's projection technology. When the device is projecting on a hard surface, it is not private enough just for the user. People around him can see the projection that is very detailed. Projection is better in the night time and dark areas rather than mornings and bright areas. This is an issue because the vision of the user can be damaged. Sixth Sense should be able to shift its projection techniques during different times of the day. That way it wont be an issue for the vision of the user. Since the device is still being modified and tested, Mistry can try to overcome concerns with projection.
Concerns about the pricing of this device is also rising mong the people. Mistry declared way back in 2009 that this device would cost $350 but ever since then there is no news about this device. Mistry is working on many other technologies and invetions, but the world doesn't know whether the work on this device has stopped. People and manufacturers who are ready to have this device do no know when this will be out.

RELATED TECHNOLOGIES

Gesture recognition:
It is a technology whichis aimed at interpreting human gestures with the help of mathematical algorithms. Gesture recognition technique basically focuses on the emotion recognition from the face and hand getsure recognition. Gesture recogniton technique enables humans to interact with computers in a more direct way without using any external interfacing devices. It can provide a much better alternative to text user interfaces and graphical user interface which requires the need of a keyboard or mouse to interact with the computer.Interfaces which solely depends on the gestures requires precise hand posing tracking. In the Sixth Sense devices coloured vands are used for this purpose. Once hand pose has been captured the gesture's can be recognised using different technique's. Neural network approaches or statistical templates are the common techniques used for the recognition purposes. This technique have an accuracy of more than 95%. Time dependent neural network will also be used for real time recognition of the gestures.

Augmented reality:
The Augmented reality is a visualiztaion technique that allows the user to experience the virtual experience added over real world in real time. With the help of advanced AR technology the information about the surrounding real world of the user becomes interactive and digitally usable. Artificial infromation about the environment and the objetcs in it can be stored and retrieved as an information layer on top of the real world view. When we compare the spectrum between virtual reality, which creates immersive, computer-generated environments, and the real world, augmented realtiy is closer to the real world. Augmented reality adds graphics, sounds, haptic feedback and smell to the natural world as it exists. Both video games and cell phones are driving the development of augmented realtiy. The augmented systems will also supreimpose graphics for every perspective available and try adjust to every movement of the user's head and eyes. The three basic componenets of na augmented reality system are the head mounted display, tracking system and mobile computer for the hardware. The main goal of this technology is to merge these three components into a highly poratble unit. The head mounted display used in augmented realtiy systems will enable the user to view superimposed graphics and text created by the system. Another component of augmented reality system is its tracking and orientation system. This system pinpoints the user's location in reference to his surrooundings and additionally tracks the user's eye and head movements.

Computer vision:
Computer vision is the technology in which machines are able to interpret/extract necessary information from an image. Computer vision technology includes various fields like image processing, image analysis and machine vision. It includes certain aspect of artificial intelligence techniques like pattern recognition. The machines which implement computer vision techniques requires image sensors which detect electromagnetic radiation which are usually in the form ultraviolet rays or light rays. The computer vision find itself applicable in various fields of interest. One such field is bio medical image processing. It's also used in autonomous vehicles like SUV's. The computer vision technique basically includes four processes.

1.Recogniton: One of the main task of computer vision technique is to determine whether the particular object contain the useful data or not.
2. Motion Analysis: Motion analysis includes several tasks related to estimation of motion where an image sequence is processed continuously to detect the velocity at each point of the image or int the 3D scene.
3. Scene Reconstruction: Computer vision technique employs several methods to recreate a 3D image from the available images of a scene.
4. Image Restoration: The main aim of this step is to remove noise from a given image. The simplest method involves using simple filters like low pass or median filters. In order to get better quality images more complex methods like Inpainting are used.

Radio Frequency Identification:
Radio frequency identification systems transmit the identity of an object wirelessly, using radio magnetic waves. The main purpose of a radio frequency identification system is to enable the transfer of a data via a poratble device. The portable device is commonly kknown as a tag. The data send by the tag is received and processed by a reader according to the needs of the application. The data send send by the tag cotains varioous information's identification or location of the information, or specifies aboout the product that has been tagged, for example price, colour, date of purchase,etc. This technology gained imporatance because of its ability to track moving object. A typical radio frequency tag consists of a microchip attached to a radio antenna which is mounted on a substrate. To retrieve data from the tag a reader is needed. A typical radio frequency reader consists of two antennas that emit radio waves and at the same time are capable of accepting the signals from the tag. The reader then passes the information that it has received to a computer device in digital format. The computer then interprets this digital data and processes it. Radio frequency identification tehniques are widely used in the fields like asset tracking, supply chain management, manufacturing, payment systems,etc. One of the major advantages of devices using radio frequency technology over other similar devices is that RFID devices need not be positioned precisely relative to the scanner. But till then there are certain areas of concern fot this technology. Some problem realted to this technology is tag collosion and reader collision. Usually the reader collision occurs when the signals from the signals from two or more readesr overlap, while tag collision occurs when many tags are present in a small area.

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 fifith Sense for disabled person.

CONCLUSION

Information is often confined to paper or computer screens. Sixth Sense frees data from these confines and seamlessly integrate inforation and reality. With the miniaturization of computing devices, we are always connected to the digital world, but there is no link between oour interactions with these digital devices and our interactions with the physical world. Sixth Sense bridges this gap by augmenting the physical world with digital information, bringing intangible information into tangible world.
Sixth Sense recognizes the objects aroound us, displaying infromation automatically and letting us access it in any way we need. The Sixth Sense prototype implements several applications that demonstrate the uefulness, viability and flexibilty of the system. The potentil of becoming the ultimate "transparent" user interface for accessing information about everything around us is present in this technology. Using this technology "Finally one gets a taste of the world of Harry Potter." Sixh Sense Technology is the science of tomorrow with the aim of connecting the physical world seamlessly, eliiminating hardware devices.

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