THE SIXTH SENSE TECHNOLOGY

Mandar Ghathe

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.
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 an 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 arrangement 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 the
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.
According to the words of its developers the extend of use of this
new device is only limited bythe imagination of human beings. Some
practical applications 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.

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 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 dynamic 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 objects we pick in our hand and then provide information relating 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 technique allows the user to interact with system with more than one finger at a time. Sixth Sense devices also incorporates 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 up to $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 graphicial 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.

RELATED TECHNOLOGIES

Gesture recognition:
It is a technology which is 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 gesture recognition. Gesture recognition 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 colored vands are used for this purpose. Once hand pose has been captured the gesture 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 visualization 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 information about the environment and the objects 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 reality 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 reality. The augmented systems will also superimpose graphics for every perspective available and try adjust to every movement of the user’s head and eyes. The three basic components of an 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 portable unit. The head mounted display used in augmented reality 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 surroundings 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.
interactions with the physical world. Sixth Sense bridges this gap by
bridging the gap between our interactions with these digital devices and our
world. We are always connected to the digital world, but there is no link
to 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 portable device. The portable device is commonly known
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 contains various information’s identification or location of
the information, or specifies about the product that has been tagged,
for example price, colour, date of purchase, etc. This technology
gained importance because of its ability to track moving objects. 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 techniques 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
device need not be positioned precisely relative to the scanner. But
till then there are certain areas of concern for this technology. Some
problem related to this technology is tag collision and reader
collision. Usually the reader collision occurs when the signals from the
tags from two or more readers 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 fifth Sense for disabled person.

CONCLUSION
Information is often confined to paper or computer screens. Sixth
Sense frees data from these confines and seamlessly integrate
information and reality. With the miniaturization of computing devices,
we are always connected to the digital world, but there is no link
between our 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 around us, displaying
information automatically and letting us access it in any way we
need. The Sixth Sense prototype implements several applications that
demonstrate the usefulness, viability and flexibility of the system. The
potential 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.” Sixth Sense Technology is the science of
tomorrow with the aim of connecting the physical world seamlessly,
eliminating hardware devices.

ACKNOWLEDGEMENT
In this paper, I would like to acknowledge Mr. Pranav Mistry for the
great and deep research work he has done in this field.

REFERENCES
039-Device-Created-at-MIT-103879.shtml
3. http://gizmodo.com/5167790/sixth-sense-technology-may-
change-how-we-look-at-the-world-forever
5. http://theviewspaper.net/sixth-sense-technology-will-
revolutionize-the-world/
TRID=816
9. Nikos Paragios and Yunmei Chen and Olivier Faugeras
Computer Vision - Principles and Practice. Elektor
International Media BV. ISBN 0905705718.