Sixth Sense Technology:The new area of innovation

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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 The key here is that Sixth Sense recognizes the objects around you, displaying information automatically and letting you access it in any way you want, in the simplest way possible. Sixth Sense is a technology and it is mini-projector coupled with a camera , cellphonewhich acts as the computer and connected to the Cloud directly and all relevantinformation stored on the web. It can also obey handmadegestures. Mapping can also done anywhere with thefeatures of zooming in otherwise zooming out. The camera also helps user to takepictures of the scene is viewing and later can arrange them on any surface.Some of the practical uses are reading a news paper and viewing videos instead of the photos in the paper Or live sport updates while reading the news papers. The device can also tell us arrival, departure or delay time of air plane on a-tickets. For book lovers it is nothing but less than a blessing. Open any book and find the Amazon ratings of the books etc.
Keywords: Gestural interface, multi-touch, free-hand gestures, sense.

1 INTRODUCTION:

We have 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 which includes eye, ear,nose, tongue mind and body 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, namelythe data, information and knowledge that mankind has accumulated about everything andwhich is increasingly all available online.Although the miniaturization of computing devices allows us to carry computers in ourpockets, keeping us continually connected to the digital world, there is no link between ourdigital devices and our interactions with the physical world. Information is confinedtraditionally on paper or digitally on a screen. SixthSense bridges this gap, bringingintangible, digital information out into the tangible world, and allowing us to interact withthis information via natural hand gestures. 'SixthSense' frees information from its confinesby seamlessly integrating it with reality, and thus making the entire world your computer.

"Sixth Sense Technology", it is the newest jargon that has proclaimed its presence in thetechnical area. Our ordinary computers will soon be able to sense the different feelings accumulatedin the surroundings and it is all a gift of the "Sixth Sense Technology" newly introduced.SixthSense is a wearable "gesture based" device that augments the physical world withdigital information and lets people use natural hand gestures to interact with that information. It was developed by Pranav Mistry[1], a PhD student in the Fluid Interfaces Group at the MITMedia Lab. A grad student with the Fluid Interfaces Group at MIT, he caused a storm withhis creation of SixthSense. He says that the movies "Robocop" and "Minority Report" gavehim the inspiration to create his view of a world not dominated by computers, digitalinformation and human robots, but one where computers and other digital devices enhancepeople's enjoyment of the physical world.Right now, we use our "devices" *(computers, mobile phones, tablets, etc.)* to go into theinternet and get information that we want.We can get Information on anything we want from anywhere within a few moments! We will not only beable to interact with things on a whole new level but also with people! One great part of thedevice is its ability to scan objects or even people and project out information regarding whatyou are looking at. Pattie Maes[2] also has an equal share of importance in this invention.

2 SIXTHSENSE TECHNOLOGY:

2.1 What is Sixth Sense?

Figure 1: Six Sences

Sixth Sense in scientific (or non-scientific) terms is defined as Extra Sensory Perceptionor in short ESP[3]. It involves the reception of information not gained through any of the fivesenses. Nor is it taken from any experiences from the past or known. Sixth Sense aims tomore seamlessly integrate online information and tech into everyday life. By makingavailable information needed for decision- makingbeyond what we have access to with ourfive senses, it effectively gives users a sixth sense.

2.2 Earlier SixthSense Prototype:

Figure 2: Early Device

2.3 Recent Prototype:

Figure 3: Present Device

Now they have switched to a smaller projector and created the pendant prototype to beworn around the neck. The SixthSense prototype is composed of a pocket projector, a mirror and a camera. Thehardware components are coupled in a pendant-like mobile wearable device. Both the projector and the camera are connected to the mobile computing device in the user's pocket. We can very well consider Sixth Sense Technology as a blend of the computer and thecell phone. It works as the device associated to it is hanged around the neck of a person and thus the projection starts by means of the micro projector attached to the device. Therefore, in course, you turn out to be a moving computer in yourself and the fingers act like a mouse anda keyboard. The prototype[4] was built from an ordinary webcam and a battery-powered 3M projector,with an attached mirror — all connected to an internet-enabled mobile phone. The setup, which costs less than $350, allows the user to project information from the phone onto anysurface — walls, the body of another person's or even your hand.We can wore the device on a lanyard around his neck, and colored Magic Marker caps onfour fingers (red, blue, green and yellow) helped the camera distinguish the four fingers andrecognize his hand

gestures with software.

3. WORKING OF SIXTH SENSE TECHNOLOGY:

3.1 Components

The hardware components are coupled in a pendant like mobile wearable device. Camera, Projector, Mirror, Mobile Components[5] etc.

3.1.1 Camera: A webcam captures and recognizes an object in view and tracks the user's hand gesturesusing computer- vision based techniques.It sends the data to the smart phone. The camera, in a sense, acts as a digital eye, seeingwhat the user sees. It also tracks the movements of the thumbs and index fingers of both ofthe user's hands. The camera recognizes objects around you instantly, with the microprojectoroverlaying the information on any surface, including the object itself or your hand.

3.1.2 Projector: Also, a projector opens up interaction and sharing. The project itself contains a battery inside,with 3 hours of battery life. The projector projects visual information enabling surfaces, wallsand physical objects around us to be used as interfaces.

We want this thing to merge with thephysical world in a real physical sense. You are touching that object and projecting info on to that object. The information will look like it is part of the object. A tiny LED projector displays data sent from the smart phone on any surface in view– object, wall, or person.

3.1.3 Mirror: The usage of the mirror is significant as the projector dangles pointing downwards fromthe neck.

3.1.4 Mobile Component:

Figure 4: SmartPhone

The mobile devices like Smartphone in our pockets transmit and receive voice and dataanywhere and to anyone via the mobile internet. An accompanying Smartphone runs the SixthSense software, and handles the connection to the internet. A Web-enabled smart phone in the user's pocket processes the video data. Other software searches the Web and interprets the hand gestures.

3.1.5 Color Markers:

Figure 5: Color Markers

It is at the tip of the user's fingers. Marking the user's fingers with red, yellow, green, andblue tape helps the webcam recognize gestures. The movements and arrangements of these makers are interpreted into gestures that act as interaction instructions for the projected application interfaces.
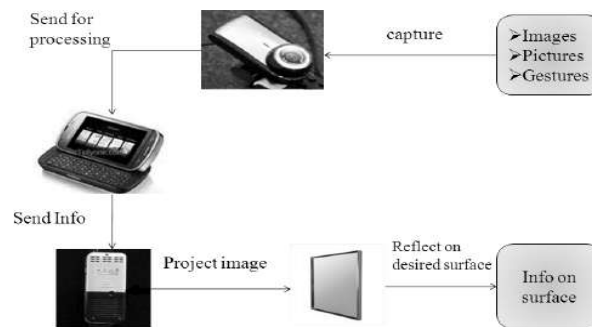
3.2 Working:

Figure 6: Working Flow

Here the digital information is freed from its confines and placed in the physical world. The entire hardware apparatus is encompassed in a pendant-shaped mobile wearable device. Basically the camera recognizes individuals, images, pictures, gestures one makes with their hands and the projector assists in projecting any information on whatever type ofsurface is present in front of the person. The usage of the mirror is significant as the projector dangles pointing downwards from the neck. To bring out variations on a much higher plane,in the demo video which was broadcasted to showcase the prototype to the world, he uses colored caps on his fingers so that it becomes simpler for the software to differentiate between the fingers, demanding various applications.The software program analyses the video data caught by the camera and also tracks downthe locations of the colored markers by utilizing single computer vision techniques. One canhave any number of hand gestures and movements as long as they are all reasonably identified and differentiated for the system to interpret it, preferably through unique and varied fiducially. This is possible only because the 'Sixth Sense' device supports multi-touchand multi-user interaction.

The idea is that SixthSense 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 information that is potentially relevant to that situation, and then the projector takes over.

The software recognizes 3 kinds of gestures:

i) Multitouch gestures, like the ones you see in Microsoft Surface or the iPhone.
where you touch the screen and make the map move by pinching and dragging.

ii) Freehand gestures, like when you take a picture [as in the photo above]. Or, youmight have noticed in the demo, because of my culture, I do a Namaste gesture to startthe projection on the wall.

iii) Iconic gestures, drawing an icon in the air. Like, whenever I draw a star, show me theweather. When I draw a magnifying glass, show me the map. You might want to use other gestures that you use in everyday life. This system is very customizable.

4 RELATED TECHNOLOGIES:

We can get instant, relevant visual information projected on any object we pick up or interact with this technology is mainly based on hand augmented reality, gesture recognition, computer vision based algorithm [6]etc.

4.1 Augmented reality:

Augmented reality[7] (AR) is a term for a live direct or indirect view of a physical real world environment whose elements are *augmented* by virtual computer-generated imagery. It is related to a more general concept called mediated reality in which a view of reality ismodified (possibly even diminished rather than augmented) by a computer. The augmentation is conventionally in real-time and in semantic context with environmental elements.

Sixth sense technology which uses Augmented Reality concept to super imposes digital information on the physical world. With the help of advanced AR technology (e.g. adding computer vision and object recognition) the information about the surrounding real world ofthe 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 ofthe real world view.The main hardware components for augmented reality are: display, tracking, inputdevices, and computer. Combination of powerful CPU, camera, accelerometers, GPS andsolid state compass are often present in modern Smartphone, which make them prospective platforms. There

are three major display techniques for Augmented Reality:
_ Head Mounted Displays
_ Handheld Displays
_ Spatial Displays

Head Mounted Displays: A Head Mounted Display (HMD) places images of both the physical world and registeredvirtual graphical objects over the user's view of the world. The HMD's are either optical see through or video see-through in nature.

Handheld Displays: Handheld Augment Reality employs a small computing device with a display that fits in auser's hand. All handheld AR solutions to date have employed video see-through techniques to overlay the graphical information to the physical world. Initially hand held AR employed sensors such as digital compasses and GPS units for its six degree of freedom tracking sensors.

Spatial Displays: Instead of the user wearing or carrying the display such as with head mounted displays orhandheld devices; Spatial Augmented Reality (SAR) makes use of digital projectors todisplay graphical information onto physical objects.

Modern mobile augmented reality systems use one or more of the following tracking technologies; digital cameras and/or other optical sensors, RFID, wireless sensors etc. Each of these technologies have different levels of accuracy and precision. Most important is thetracking of the pose and position of the user's head for the augmentation of the user's view.For users with disabilities of varying kinds, AR has real potential to help people with avariety of disabilities. Only some of the current and future AR applications make use of a Smartphone as a mobile computing platform.

4.2 Gesture Recognition:

Gesture recognition is a topic in computer science and language technology with thegoal of interpreting human gestures via mathematical algorithms. Gestures can originate fromany bodily motion or state but commonly originate from the face or hand. Current focuses inthe field include emotion recognition from the face and hand gesture recognition. Many approaches have been made using cameras and computer vision algorithms to interpret signlanguage.

Gestures can exist in isolation or involve external objects. Free of any object, we wave,beckon, fend off, and to a greater or lesser degree (depending on training) make use ofmore formal sign languages. With respect to objects, we have a broad range of gesturesthat are almost universal, including pointing at objects, touching or moving objects,changing object shape, activating objects such as controls, or handing objects to others.

Gesture recognition[8] can be seen as a way for computers to begin to understand humanbody language, thus building a richer bridge between machines and humans than primitive text user interfaces or even GUIs (graphical user interfaces), which still limit the majority ofinput to keyboard and mouse. Gesture recognition enables humans to interface with themachine (HMI) and interact naturally without any mechanical devices. Gestures can be used to communicate with a computer so we will be mostly concernedwith empty handed semiotic gestures. These can further be categorized according to theirfunctionality.
_ Symbolic gestures: These are gestures that, within each culture, have come to a single meaning. An Emblemsuch as the "OK" gesture is one such example, however American Sign Language gestures also fall into this category.
_ Deictic gestures: These are the types of gestures most generally seen in HCI and are the gestures of pointing, or otherwise directing the listeners attention to specific event or objects in the environment.
_ Iconic gestures: As the name suggests, these gestures are used to convey information about the size, shape or orientation of the object of discourse. They are the gestures made when someone says "The plane flew like this", while moving their hand through the air like the flight path of the aircraft.
_ Pantomimic gestures:These are the gestures typically used in showing the use of movement of some invisibletool or object in the speaker's hand. When a speaker says "I turned the steering wheel hard tothe left", while mimicking the action of turning a wheel with both hands, they are making a pantomimic gesture.

Using the concept of gesture recognition, it is possible to point a finger at the computer screen so that the cursor will move accordingly. This could potentially make conventional input devices such as mouse, keyboards and even touch-screens redundant. Gesture recognition can be conducted with techniques from

computer vision and image processing. The literature includes ongoing work in the computer vision field on capturing gestures ormore general human pose and movements by cameras connected to a computer.

4.3 Computer vision based algorithm:

Computer vision is the science and technology of machines that see. As a scientific discipline, computer vision is concerned with the theory behind artificial systems that extract information from images. The image data can take many forms, such as video sequences, views from multiple cameras, or multi-dimensional data from a medical scanner. Computer vision, on the other hand, studies and describes the processes implemented in software and hardware behind artificial vision systems. The software tracks the user's gestures using computer-vision based algorithms. Computer vision is, in some ways, theinverse of computer graphics. While computer graphics produces image data from 3D models, computer vision often produces 3D models from image data. There is also a trend towards a combination of the two disciplines, e.g., as explored in augmented reality.

The fields most closely related to computer vision are image processing, image analysis and machine vision. Image processing and image analysis tend to focus on 2D images, howto transform one image to another.

His characterization implies that image processing/ analysis neither require assumptions nor produce the interpretations about the image content. Computervision tends to focus on the 3D scene projected onto one or several images. e.g. how to reconstruct structure or other information about the 3D scene from one or several images.Machine vision tends to focus on applications, mainly in manufacturing.

The Recognition Algorithms: The computer vision system for tracking and recognizing the hand postures that controlthe menus is based on a combination of multi-scale color feature detection, view based hierarchical hand models and particle filtering. The hand postures or states are represented interms of hierarchies of multi-scale color image features at different scales, with qualitative inter-relations in terms of scale, position and orientation. In each image,detection of multiscale color features is performed. The hand postures are then simultaneously detected and tracked using particle filtering, with an extension of layered sampling referred to ashierarchical layered sampling. To improve the performance of the system, a prior on skincolor is included in the particle filtering. e.g. vision based autonomous robots and systems for vision based inspection or measurement.

4.4 Technologies that uses Sixth Sense as Platform:

Sixth Sense technology takes a different approach to computing and tries to make the digital aspect of our lives more intuitive, interactive and, above all, more natural. When you bring in connectivity, you can get instant, relevant visual information projected on any objectyou pick up or interact with. So, pick up a box of cereal and your device will project whether it suits your preferences. Some of the technologies that uses this are Radio Frequency Identification, gesture gaming, washing machine.

4.4.1 Radio Frequency Identification:

Sixth Sense is a platform for Radio Frequency Identification based enterprise intelligence that combines Radio Frequency Identification events with information from other enterprise systems and sensors to automatically make inferences about people, objects, workspaces, and their interactions. Radio Frequency Identification is basically an electronic tagging technology that allows the detection and tracking of tags and consequently the objects that they are affixed to. This ability to do remote detection and tracking coupled with the low cost of passive tags has lead to the widespread adoption of RFID in supply chains worldwide.

Pranav Mistry, a researcher at the media lab of the Massachusetts Institute Technology, has developed a 'sixth sense' device – a gadget worn on the wrist that can function as a 'touch screen' device for many modern applications. The gadget is capable of selecting a product either by image recognition or radio frequency identification (RFID) tags and project information, like an Amazon rating. Applications can either poll these databases by running SQL queries or set up triggers to be notified of specific events of interest. Sixth Sense infers when a user has interacted with an object, for example, when you pick up your mobile phone.

5 APPLICATIONS

The Sixth Sense prototype implements several applications that demonstrate the usefulness, viability and flexibility of the system.The Sixth Sense device has a huge number of applications. The following are few

of the applications of Sixth Sense Technology.

_ Make a call
_ Call up a map
_ Check the time
_ Create multimedia reading experience
_ Drawing application
_ Zooming features
_ Get product information
_ Get book information
_ Get flight updates
_ Feed information on people
_ Take pictures
_ Check the email

6 ADVANTAGES & ENHANCEMENTS:

6.1 Advantages:

i) Sixth Sense is an user friendly interface which integrates digital information into the physical world and its objects, making the entire world your computer.

ii) Sixth Sense does not change human habits but causes computer and othermachines to adapt to human needs.

iii) It uses hand gestures to interact with digital information. iv)Supports multi-touch and multi-user interaction v)Data access directly from machine in real time

vi) It is an open source and cost effective and we can mind map the idea anywhere

vii) It is gesture-controlled wearable computing device that feeds our relevant information and turns any surface into an interactive display.

viii) It is portable and easy to carry as we can wear it in our neck.

ix) The device could be used by anyone without even a basic knowledge of a key-board or mouse.

x) There is no need to carry a camera anymore. If we are going for a holiday, then from now on wards it will be easy to capture photos by using mere fingers[9].

6.2 Future Enhancements:

1) To incorporate camera and projector inside mobile computing device.

2) Whenever we place pendant- style wearable device on table, it should allow us touse the table as multi touch user interface.

3) Applying this technology in various interest like gaming, education systems etc.

4)To have 3D gesture tracking.

5)To make sixth sense work as fifth sense for disabled person.

7 CONCLUSION

It is a platform in that its programming model makes the inferences made automatically available to applications via a rich set of APIs. To demonstrate the capabilities of the platform, the researchers have prototyped a few applications using these APIs, including a misplaced object alert service, an enhanced calendar service, and rich annotation of video with physical events.

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