Six Sense Technologies: Multi-technology & Multi-application Era

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Abstract— **Nowadays, Sixth Sense Technology is a new era. It has mini-projector which is integrated with a camera and a cellphone—which acts as the computer connected to the internet. Sixth Sense can also scan hand gestures. It is the latest technology based on sensors and computers. The Camera can scans objects around a person instantly while the micro-projector can display the information on any surface, including the object itself or even hand also. It is multi application field. One can make a call by extending hand on front of the projector and numbers will be appeared for clicking. One can know the time by drawing a circle on wrist and a watch will be shown. One can take a snap by just make a square with fingers, highlighting what one wants to frame, and the system will make the photo. The small device which has a huge number of applications is portable and easy to carry as one can wear it in neck. This paper discusses the different technologies used to implement Six Sense technology. It also discusses its major application fields.**

I. Introduction

Human is using his organs over millions of years to sense the world. But he cannot access the most useful information for decision making like weather forecasting, identifying a person at a place. Mankind has accumulated information about everything and which is now increasingly available online. Today, computers help us to easily connect with digital world but there is a large gap between the digital world and original physical world. Information is confined traditionally on paper or digitally on a screen. It is only the SixthSense which bridges this gap and make intangible digital information out into the tangible world, and allowing us to interact with this information via natural hand gestures. Today, Sixth Sense Technology is the newest developed technique in scientific world. Our ordinary computers will soon be able to sense and process the information about the different things accumulated in the surroundings and it is all due to newly introduced "Sixth Sense Technology".

Fig1 Six Sense

Sixth Sense in scientific terms is defined as Extra Sensory Perception or in short ESP. It does not concern with the information gained through five human senses or his own experience. It has a physical sensor i.e. camera known as digital eye which makes needed information available for decision-making with the help of projector, mirror and internet enabled pocket device. The whole apparatus effectively gives users a sixth sense.

As shown in Figure 1, 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 projects any information on whatever type of surface is present in front of the person with the help of mirror as shown in Figure 2. User can use colored caps on his fingers so that it becomes simpler for the software to differentiate between the fingers and enable it to provide various applications.

The software program analyses the video data which is caught by the camera and also tracks down the locations of the colored markers by utilizing single computer vision techniques. One can have 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 fiducials. So, the 'Sixth Sense' device has been designed for multi-touch and multi-user interaction.
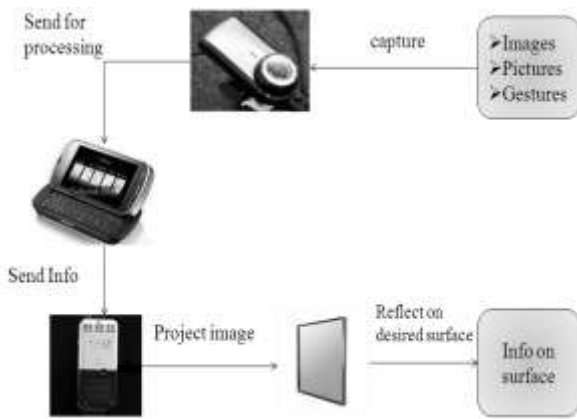
Fig2: Working of Six Sense

II. RELATED TECHNOLOGIES

The technology is based on multiple disciplines e.g. hand augmented reality, gesture recognition, computer vision based algorithm etc.

II(a) Augmented reality:

Augmented reality (**AR**) is a live direct or indirect view of a physical, real-world environment whose elements are *augmented* (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data. It is related to a more general concept called mediated reality, in which a view of reality is modified (possibly even diminished rather than augmented), by a computer [7]. As a result, the technology functions by enhancing one's current perception of reality. The augmentation is conventionally in real-time and in semantic context with environmental elements. Hardware components for augmented reality are: processor, display, sensors and input devices. Modern mobile computing devices like smart phones and tablet computers contain these elements which often include a camera and MEMS sensors such as accelerometer, GPS, and solid state compass, making them suitable AR platforms. Various technologies are used in Augmented Reality rendering including optical projection systems, monitors, hand held devices, and display systems worn on one's person [6].

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 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. There are three major display techniques for Augmented Reality:

Head Mounted Displays: A Head Mounted Display (HMD) places images of both the physical world and registered virtual graphical objects over the user's view of the world.

Handheld Displays: Handheld Augment Reality employs a small computing device with a display that fits in a user's hand.

 Spatial Displays: Instead of the user wearing or carrying the display such as with head mounted displays or handheld devices; Spatial Augmented Reality (SAR) makes use of digital projectors to display 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 the tracking 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 a variety of disabilities. Only some of the current and future AR applications make use of a Smartphone as a mobile computing platform.

II(b) Gesture Recognition

Gesture recognition is a topic of computer science and language technology. It has the mission to interpret human gestures using mathematical algorithms. The gestures origin is via motion or change of state of any body part but mostly from the face or hand. So, to interpret sign language, cameras and computer vision algorithms generate multiple approaches. Gestures can be recognized singly or in combination of external objects too. Universally, a broad range of gestures are available which includes pointing at objects, touching or moving objects, changing object shape, activating objects such as controls, or handing objects to others. Gesture recognition can be seen as a new technique to input data or computers via human body 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 input via keyboard and mouse. Gestures can further be categorized according to their functionality.

Symbolic gestures: These are gestures that have a single meaning within each culture e.g. an Emblem such as the "OK" gesture. American Sign Language gestures also fall into this category.

Deictic gestures: These 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 moves his hand through the air to show the flight path of the aircraft.

Pantomimic gestures: These are the gestures which are typically used in showing the use of movement of some invisible tool or object in the speaker's hand e.g. when someone mimics the action of turning a wheel with both hands, he is making a pantomimic gesture. Gesture recognition can

be implemented via techniques of computer vision and image processing.

II(C). Computer vision based algorithm

Computer vision is the science and technology of machines that provides digital eye. So, it is a scientific discipline, which is concerned with the theory on which artificial systems that extract information from images are based. The image data can be of multiple forms, such as video sequences, views from multiple cameras, or multi-dimensional data from gathered through a medical scanner.

Computer vision, on the other hand, studies and describes the processes that should be executed by software and hardware to implement artificial vision systems. The software scans processes and records the user's gestures using computer-vision based algorithms. Computer vision is, in some ways, seems to be the inverse of computer graphics. While computer graphics produces image data from 3D models, computer vision often produces 3D models from image data. The fields of computer vision are image processing, image analysis and machine vision. Image processing and image analysis tend to focus on 2D images whereas computer-vision 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 e.g., vision based autonomous robots and systems for vision based inspection or measurement.

The Recognition Algorithms: The hand postures or states are represented in terms 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 multi-scale color features is performed. The hand postures are simultaneously detected and tracked using particle filtering, with hierarchical layered sampling which is an extension of layered sampling. A prior on skin color is included in the particle filtering in order to improve the performance of the system.

III. Technologies that uses Sixth Sense as Platform

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

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 led 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.   Sixth Sense uses Radio Frequency Identification technology with a bunch of other enterprise systems like the calendar system or online presence that can track user activity. In future, enterprise setting can be considered where people (or rather their employee badges) and their personal objects such as books, laptops, and mobile phones are tagged with cheap, passive RFID tags, and there is good coverage of RFID readers in the workplace. The technology is able to automatically differentiate between people tags and object tags, learn the identities of people, infer the ownership of objects by people, and learn the nature of different zones in a workspace e.g., private office versus conference room, and perform other such inferences. By combining information from these diverse sources, Sixth Sense records all tag-level events in a raw database. The inference algorithms consume these raw events to infer events at the level of people, objects, and workspace zones, which are then recorded in a separate processed database.

Sixth Sense Washing Machine: Whirlpool AWOE 8758 White Washing Machine is a remarkable front loader that is based on the unparalleled Sixth Sense technology. Whirlpool's 2009 range of washing machines comes integrated with enhanced Sixth Sense technology that gives more optimization of resources and also increased saving in terms of energy, water and time.

Ideal washing machine requires sixth sense to detect stubborn stains and adjust wash impact accordingly to enhance the washing performance and dexterously assist in heavy washing loads.

The New Generation Sixth Sense appliances from Whirlpool are helping to protect the environment and to reduce electricity consumption. Whirlpool Sixth Sense appliances are designed to be intelligent and energy efficient appliances that adapt their performance to better suit your needs. All Whirlpool appliances with intelligent Sixth Sense technology work on three key principles; Sense, Adaptation and Control. They ensure that they achieve optimal performance each and every time that they are used. Whirlpool Sixth Sense washing machines can save 50% water, energy and time during the

cycle. These intelligent machines sense the size of the load and then adjust and control the cycle accordingly for optimal use of water, energy and time. Some models also contain a detergent overdosing monitor to optimize the use of washing detergent. Tumble dryers use 6th Sense technology to minimize energy and time wastage by monitoring the humidity inside laundry and adjusting the drying time accordingly.

IV. Applications of Six Sense

The Sixth Sense device has a huge number of applications. The following are few of the applications of Sixth Sense Technology.

IV(a). Make a call

Figure 3: Virtual Keypad

IV(b). Call up a map

The sixth sense also lets the user display the map on any physical surface to find his destination. He can use his thumbs and index fingers to navigate the map, for example, to zoom in and out and use other controls also.
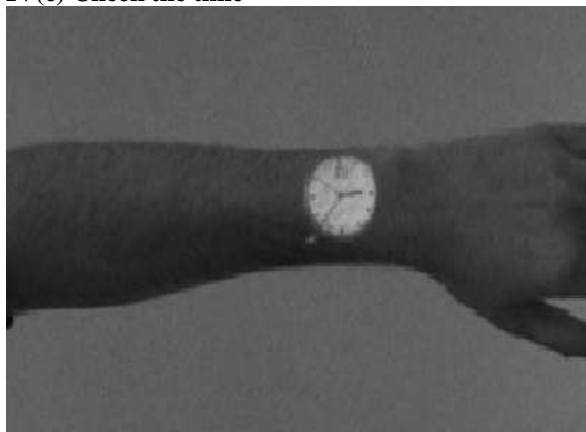
IV(c) Check the time

Figure 4: Virtual Watch

With Sixth Sense, one can draw a circle on his wrist with his index finger to get a virtual watch that displays the correct time. The computer tracks the red marker cap or piece of tape, recognizes the gesture, and instructs the projector to flash the image of a watch onto his wrist.

IV(d) Create multimedia reading experiences

The Sixth Sense system also facilitates the user by providing more information about the objects to which the user is interacting. For example, a newspaper can show live video news or dynamic information can be provided on a regular piece of paper. Thus a piece of paper turns into a 3D-video display.

IV(e) Drawing application

Figure 5: Drawing

The drawing application lets the user draw on any surface by tracking the fingertip movements of the user's index finger.

IV(f) Get product information

Sixth Sense uses image recognition to recognize products one pick up, and then feeds that information of those products. For example, if one is trying to shop "green" and are looking for paper towels with the least amount of bleach in them, the system will scan the product that one pick up off the shelf and give him guidance on whether this product is a good choice for him.

IV(g) Get book information

Sixth Sense uses image recognition or marker technology to recognize products user picks up, and then feeds that information on books. The system can project Amazon ratings

on that book, as well as reviews and other relevant information.

IV(h) Take pictures

Figure 7: Take Pictures

If user makes his index fingers and thumbs to represent a square i.e. the typical "framing" gesture, then the system will snap a photo. After taking the desired number of photos, he can project them onto a surface, and use gestures to sort through the photos, and organize and resize them.

V. Advantages and Enhancements

V(a) Advantages
i.   SixthSense is an user friendly interface which integrates digital information into the physical world and its objects, making the entire world your computer.
ii.   SixthSense does not change human habits but causes computer and other machines 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 keyboard 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.

V(B) Future Enhancements
i.   To get rid of color markers.
ii.   To incorporate camera and projector inside mobile computing device.
iii. Whenever we place pendant- style wearable device on table, it should allow us to use the table as multi touch user interface.
iv.   Applying this technology in various interest like gaming, education systems etc.
v.   To have 3D gesture tracking.
vi.   To make sixth sense work as fifth sense for disabled person.

VI. CONCLUSION

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. We shouldn't have to think about it separately. It uses a lot of complex technologies which are squeezed into a simple portable device. When we bring in connectivity, we can get instant, relevant visual information projected on any object we pick up or interact with.

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