

A Comprehensive Survey on Sixth Sense Technology

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Abstract— Sixth sense Technology is a wearable gestural interface which augments the physical world around us with the digital world and it enables the user to use their natural hand gestures to interact with that such information. It is a neck-worn gestural interface in which two main components are used; a data projector and a camera. This technology enables the user to connect with the internet. This technology works on the principles of image processing and gestural recognition. This technology has established a new field in Human Computer Interaction. In this paper we present a brief study or review on sixth sense technology.

Keywords- Sixth Sense Technology; Methodology; System analysis; Applications

I. INTRODUCTION

The whole world is entirely depends upon the technology. As the importance of technology is in everywhere like in health department, finance department, education, corporate world etc. As the demand of the technology is increasing day by day then the size of the computer is decreasing day by day. One such innovation is the sixth sense technology. Sixth Sense technology is a wearable gestural interface in which we integrate the physical world with the digital world. It uses the camera and a projector mounted in a pendant like wearable device. This technology eliminates the use of traditional input devices and with the help of gestures; we can communicate with our devices very easily. Hence, sixth sense technology bridges the gap between the human world and the digital world [12]. Sixth sense technology works on the principle of gesture recognition. A gesture may be defined as a movement of the hand or face that expresses the idea, sentiments or emotions [8]. Hence, gestures are used in sixth sense for generating a command for practical interaction and it controls various objects easily. So, gestures are widely used in Sixth Sense as they play a vital role in the Human Computer Interaction [13].

II. LITERATURE SURVEY

A large amount of work is being done in this technology and researchers carried out their work in the field of Human Computer Interaction. They use the web cameras and gestures act as an input to these cameras. After that these gestures can be detected, tracked and analyzed. To achieve these gestures, we use various image processing techniques.

Cootes et al, [1] describes the Active Shape Models (ASM) for the tracking of the deformable objects. They use a technique for building compact models for the flexible objects seen in the 2-D images.

A.Erdem et al, [2] describes the tracking by using finger tip for controlling the motion of the mouse. In mouse button, the clicking option was implemented by assigning a screen such that a click is occurred when the user's hand is passed over the region.

Robertson et al, [3] describes the another method for clicking. They used the motion of the thumb for the purpose of clicking events. Movement of the hand while making a special gesture moves the mouse pointer on the screen.

Abhik Banerjee et al, [4] entitled a paper in which he had tried to control the movements of the mouse cursor and click events by using a camera, based on colour detection technique. They basically focus on the use of a camera to develop a virtual human computer interaction device in a cost effective manner.

Mitra, S. and Acharya [5] presented a survey on gesture recognition with particular emphasis on hand gestures and facial expressions. Applications involving Hidden Markov Models, particle filtering and condensation, finite-state machines, optical flow, skin color, and connectionist models.

Panwar. M. [6] in the paper proposed a system that employed K-means clustering technique of segmentation for segmenting the hand object from rest of the background, in order to calculate shape based features. The system was able to recognize 45 different gestures on the bases of 5 bit binary string. The recognition rate achieved was 94%.

Cui and Weng [7] develop a non-HMM-based system which can recognize 28 different gestures in front of complex backgrounds. The recognition of this system is 93.1% but it relies on a slowly segmentation scheme which takes 58.3 sec for each image.

Gaurav Subhash Nikam, [8] describes the sixth sense as a wearable gestural interface that integrates the physical world around us with the digital world. They consider sixth sense technology as a 'Wearable computer' which consists of various hardware components. Author executed the sixth sense technology as a neck warn projector with a webcam.

Shany Jophin, [9] proposed the concept how to remove the traditional hardware components like mouse by using sixth sense technology. By using color markers and the motion sensors, they are able to operate the working procedure of the mouse. They use the camera for detecting the RGB color markers to implement the hand tracking in real time.

Aakanksha Chopra,[10] mainly focused on the sixth sense technology for the security purpose. Whenever the attack is found on the internet, it is going to detect the attacks.

III. SYSTEM ANALYSIS

The sixth sense technology uses different technologies like gesture recognition, image processing, etc. At present the commercial product isn't launched but the prototype is prepared [17]. The sixth sense prototype is made using very common and easily available equipments like pocket projector, a mirror, mobile components, color markers and a camera. Figure 3.1 shows the working of the sixth sense technology.

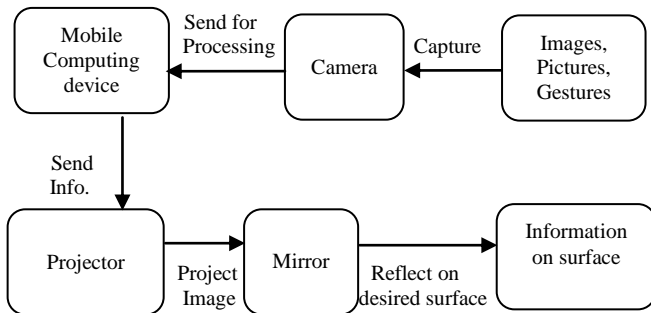


Figure 1. Working of Sixth Sense Technology

- First, the camera acts as a digital eye which captures and track the images or videos and then pass it to the mobile computing device.
- Then, the processing of the program starts where streaming of data takes place and interprets the movements into gestures. The gestures are different from one another and are assigned some commands.
- These gestures can act as input to application which is projected by the projector.
- The Projector basically comprises of four main parts: the electronics, laser light sources, combiner optic and scanning mirrors.
- In projector, the electronic system turns the image into the electronic signal.
- Then the electronic signal drive laser light sources with different colors and intensities down different path.
- After that in the combiner optic, the different light paths are combined into one path demonstrating a pallet of colors.
- Finally the mirror copies the image pixel by pixel and can then project the image.
- The projector is aligned downwards for compactness; therefore images would be formed at the user's feet if mirror wasn't used. The mirror reflects the image formed by the projector to front.
- The entire hardware is fabricated in the form of a pendent.
- It works very similar like a touch screen phone with entire world as the screen.

IV. METHODOLOGY

The main motive of the Sixth Sense Technology is to capture the images made by the user and automatically save these images into the memory without the help of any input device controlling manually by hand. The methodology is given as:

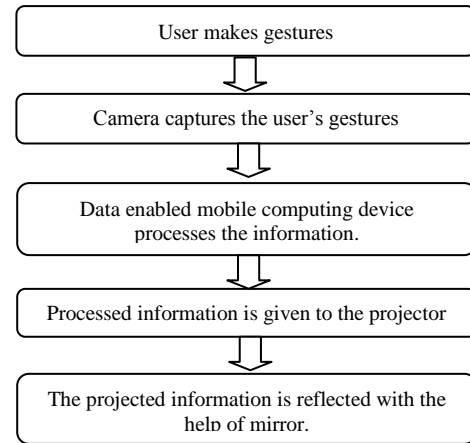


Figure 2. Flow chart of the Sixth Sense Technology

Firstly, the camera captures the objects and tracks the user's hand gestures. The color markers red, blue, green and yellow are used at the tip of the user's finger which helps the camera to recognize the hand gesture [18]. The movements and arrangements of these color markers are interpreted into gestures that act as a instruction for the projected application. The mobile computing device searches the web and interprets the gestures with the help of color markers [19]. The information or image from the mobile computing device can be projected into any surface and the mirror reflects that image onto any surface or wall.

To develop an application based on sixth sense technology:

- Language: Java, C#, C++
- Image processing software: MatLab.

V. TECHNOLOGIES

Sixth-Sense uses technologies like augmented reality, computer vision, Hand Tracking, Gesture recognition, & Radio frequency.

A. Augmented Reality

Augmented reality is a technology in which we augment the physical world into the digital world. It is the direct and indirect view of physical related objects, whose images are supplemented by most of the computer generated images [12].With the help of this advanced technology, the information about the real world becomes more interactive and digitally usable. Augmented reality provides sound, graphics and smell to the natural world as it exists. The augmented reality main components are head mounted display, tracking system and mobile computer. Augmented reality can be used in education, architectural designing etc.

B. Computer Vision

Computer vision is the technology in which we go through the detailed study of the image. It includes the capturing and analysis of the real image. In general computer vision provides the symbolic information from the real world [12]. Various applications include biomedical image processing, in industry, in military application etc. The computer vision involves four processes: Recognition- to find whether the particular object contain the data or not; Motion Analysis- includes the estimation of motion; Scene reconstruction- recreates a 3D image from the available image; Image restoration- method using low pass or median filters to remove noise from the given image.

C. Hand Tracking

Hand tracking is the major problem in the image processing and to solve this problem, the most effective method used is the Tower tracking method. A tower is required to recognize the existence of chosen features [15]. So, the distribution of these towers in image and the features of the object involve the robustness and accuracy of the goal.

D. Gesture Recognition

Gesture recognition is the technology in which we use mathematical algorithms to identify human gestures. Gesture recognition is used for the recognition of the hand, tracking of the hand movements and also provides information regarding the orientation and flux of the fingers [14]. This technique has a high accuracy usually showing accuracy of more than 95%.

E. Radio Frequency

It is the wireless technology which uses the radio frequencies to transfer data for the purposes of automatically identifying and tracking tags attached to objects [12]. This tracking tag contains the stored information in electrical form. Some tracking tags are used at short ranges via the magnetic fields. This technology allows the tracking as well as detection of the objects.

VI. APPLICATIONS OF THE SIXTH SENSE TECHNOLOGY

Sixth sense technology has a vast no. of applications; some of the applications listed are-

A. Taking Pictures

With just the movement of hand gestures, user can take the pictures. Webcam recognizes the gesture & the framing to which the user is pointing to, this particular recognized frame will be stored in the mobile component. & can be displayed on any particular surface by using projector.

B. Mapping Application

This application helps the user for navigation mapping and it will be displayed on any screen of the wall by using simple hand gestures. Various hand gestures involves zoom in, zoom out etc.

C. Drawing Application

This application helps the user to draw icons with the index finger and tracking can be done with the help of fingertip movements.

D. Make a Call

To make a call, extend your hand on front of the projector and numbers will appear for you to.

E. Multimedia Reading Experience

Reading a newspaper and viewing videos instead of the photos in the paper or live sports updates while reading the paper.

F. Used For Checking Time

A user can draw a circle on his/her wrist to get a virtual watch and it will give us the correct time.

VII. FUTURE ENHANCEMENT

This is one of the upcoming technologies which will enhance the standard of the image processing domain. Following are the points regarding the future scope:

A. No Usage of Mouse

In Sixth Sense technology, there is a tremendous development occur which eliminates the usage of Mouse. It will consider as 'Mouse less'. The task of the mouse is done with the help of fingers by using different color markers. This technology eliminates various traditional input devices and also combines the physical world with the digital world. In this technology, we will consider an infrared laser beam and infrared camera which are embedded inside the computer. If the physical mouse is present underneath then the user will make different gestures, a laser beam focuses on the gestures and the IR camera detects these gestures by using the technique computer vision. The positions and arrangement of these gestures can be used for the purpose of clicking as well as cursor movements.

B. Third Eye

This is a newly invented technology where various viewers can see the multiple things at the same time on a same screen. This technique is basically used in the Public sign boards where the American tourists can read all the instructions in their English language and the Chinese tourists can read all the instructions in the Chinese language. With the help of this technique, we can resolve the various conflicts which occur due to sharing of a single platform.

C. Inktuitive

Earlier, most of the designers can prefer pen and pencil for the purpose of designing. But due to the tremendous development in the computer aided design tools, it will reduce the intuition of pen and pencil which is used for the designing purposes. Inktuitive is the one of the recent advancement in the computer aided design tools. Here, the ultrasonic pen with IR led is used for drawing lines and different shapes. These lines and shapes are firstly captured and the translated these shapes into the digital world. The main aim of this technique is to bridges the gap between the physical world and the digital world.

VIII. CHALLENGES

A lot of challenges associated with the sixth sense technology and their main concern is basically on the accuracy. Many shortcomings included in this are based on the instruments which are used in gesture recognition. In this technology, viability in terms of implementations is one of the main issues

where noise degrades the performance. Furthermore, longer distance can create many resolution hurdles which lead to abrupt change in accuracy.

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