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Empowering the Education Sector with Sixth Sense

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Abstract: ***This paper is intended to enlighten the reader about the Sixth Sense technology that is emerging rapidly in the field of technological interaction, emphasizing upon the use of this technology in the Education System. Sixth Sense can be thought of as a wearable gesture interface that augments the real world around, applying concepts of Artificial Intelligence which is the study of human intelligence such that it can be replicated artificially, enabling the creation of intelligent machines that work and react like humans. It signifies human-computer interaction and can have varied applications, and we intend to elaborate upon the uses and applications of this technology in a learning environment in this paper. To understand the applications of Sixth Sense technology, we must first understand the implementation of it, and therefore, we have also explained a prototype of the technology that has been developed. Merging these applications with a practical approach, namely, the Education System, we have shown how the Sixth Sense technology can be used effectively in a campus.***

Keywords: Sixth Sense, Artificial Intelligence, Augmented Reality, Human-Computer Interaction, Computer Vision, Education System

1. Introduction

With a series of innovation of new technologies, computer science has come a long way. While some of these technologies do not withstand the pressure of acceptance, some stand out. One of these is the Sixth Sense technology, which marks the beginning of a new tangent to the sphere of Artificial Intelligence. We have all noticed this technology, in the form of displays on walls, or gestural instructions to carry out a specific task. Although a lay man would only think of this as a simple computer application, there is a plethora of processes that run in the backend to enable this. These processes, when grouped together, are nothing but Sixth Sense. Think of the five senses of humans, sight, taste, hearing, touch and smell. What do these senses do? They enable every form of biological functionality of a human. Now, think about an additional sense, the Sixth Sense technology, which enables humans to sense things that are not basic and biological with an integration of the physical world with the digital world. Sixth Sense technology can be used to instantly draw out information about an object as soon as it is noticed in our surrounding.

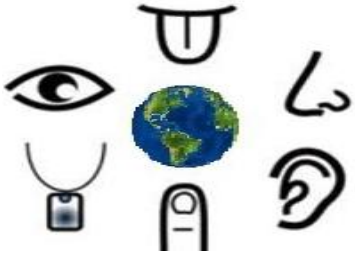

Figure 1: Five Senses and the Sixth Sense [1]

Figure 1 shows the five senses of a human and also the Sixth Sense depicted in the form of a wearable around-the-neck device.

Sixth Sense technology is based upon the realm of Artificial Intelligence (AI). AI is the science and engineering of making intelligent machines, especially intelligent computer programs [2]. What was once only a figment of our imagination has now turned into reality with the evolution of Artificial Intelligence. The very premise of AI technology is its ability to continually learn from the data it collects. The more data there is to collect and analyze through carefully crafted algorithms, the better the machine becomes at making predictions. Sixth Sense, being an application of AI, augments the physical world around us with digital information through the use of hardware components that are coupled together in a pendant-like mobile wearing device. The application of Sixth Sense technology in the education sector has been a subject of academic research for a while. It brings together Artificial Intelligence, which is in itself interdisciplinary, and the learning sciences, to promote the development of adaptive learning environments.

2. Prototype of Sixth Sense Technology

Sixth Sense brings intangible, digital information out into the tangible world, and allows us to interact with this information via natural hand gestures. Sixth Sense frees information from its confines by seamlessly integrating it with reality, and thus making the entire world your computer [3].

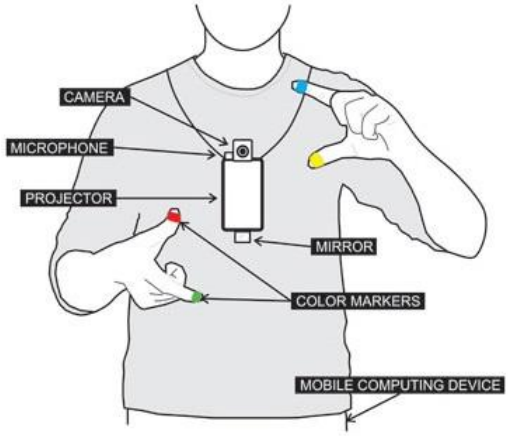

Figure 2: Sixth Sense Prototype [4]

Figure 2 shows that the Sixth Sense prototype is comprised of a pocket projector, a mirror and a camera. The hardware

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. The projector projects visual information enabling surfaces, walls and physical objects around us to be used as interfaces; while the camera recognizes and tracks user's hand gestures and physical objects using computer-vision based techniques. The software program processes the video stream data captured by the camera and tracks the locations of the colored markers (visual tracking fiducials) at the tip of the user's fingers using simple computer-vision techniques. The movements and arrangements of these fiducials are interpreted into gestures that act as interaction instructions for the projected application interfaces. The maximum number of tracked fingers is only constrained by the number of unique fiducials, thus Sixth Sense also supports multi-touch and multi-user interaction [3].

The Sixth Sense prototype implements several applications that demonstrate the usefulness, viability and flexibility of the system. The map application lets the user navigate a map displayed on a nearby surface using hand gestures, similar to gestures supported by Multi-Touch based systems, letting the user zoom in, zoom out or pan using intuitive hand movements. The drawing application lets the user draw on any surface by tracking the fingertip movements of the user's index finger. Sixth Sense also recognizes user's freehand gestures (postures). For example, the Sixth Sense system implements a gestural camera that takes photos of the scene the user is looking at by detecting the 'framing' gesture. The user can stop by any surface or wall and flick through the photos he/she has taken. 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 a '@' symbol lets the user check his mail. The Sixth Sense system also augments physical objects the user is interacting with by projecting more information about these objects projected on them. For example, a newspaper can show live video news or dynamic information can be provided on a regular piece of paper. The gesture of drawing a circle on the user's wrist projects an analog watch [3] [5].

3. Practical Approach

Sixth Sense, the kind of technology that it is, can have its applications and advantages noticed in almost all fields. Restricting our outlook to the application of Sixth Sense in the Education Sector, we studied numerous possible outcomes of how this technology can be implemented in a college environment. In any educational institution, the basic activities include the following:

- Virtual Classroom
- Student Information System
- Library Management System
- Student Attendance
- Notice Display

Elaborating upon these specific approaches, we can show how Sixth Sense can be implemented and proposing a few areas where this technology can be useful.

3.1 Virtual Classroom

When you think of learning, the first visual that comes to our minds is that of a classroom. The traditional learning approach has taught us a lot, but there is a lot of scope for improvement in this field. When technology is at our beck and call, especially Sixth Sense, what comes next could be revolutionary. If students do not restrict themselves to traditional norms of learning, Sixth Sense can give learning a whole new meaning with a virtual classroom.

In a virtual classroom, students can use the Sixth Sense wearable device to carry out activities. For example – if a student wants to gain insight into a topic that has been written on the board, he can place the camera's focus onto it, and the system will automatically search available content on the Internet; if a student wants to take a picture of any piece of information or scan a document, all s/he would have to do is make a frame-like hand gesture and the markers will pick up the information and scan the content; if a student or teacher wants to present something, all they would have to do is find a surface to accommodate the screen that the projector in a Sixth Sense device would create. These are few examples from a wide range.

3.2 Student Information System

Currently, obtaining student information is a tedious task. The student has to go to the office, wait in a queue and verbally convey his/her credentials to the administration. Only then will any kind of student information be available. This entire routine can be enhanced using Sixth Sense. For example, consider the following scenario – a student requires information about his/her scorecard, instead of going to the office, the student can perform a particular gesture, say drawing 'I' which will enable him to directly scan his college ID through the camera available in the wearable Sixth Sense device. After processing this information, a display can be set up on any nearby surface, and using touch markers, s/he can select the necessary documents to be viewed. Figure 3 below depicts this process in the form of a flow graph.

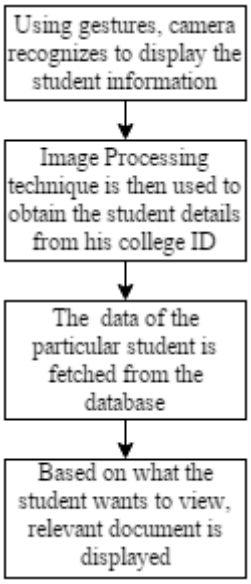

Figure 3: Student Information System

3.3 Library Management System

Sixth Sense can be used in multiple ways in a library environment. Referring to the following graphs, we can see a few of its applications.

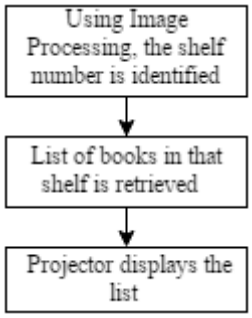

Figure 4 (a): Library Management System

Figure 4 (a) shows one of the implications of the use of Sixth Sense in a library. Camera recognizes the shelf the student is standing in front of. Using the shelf number, the processor retrieves the list of books that have been kept in that particular shelf from a database and then the projector displays this information on a surface.

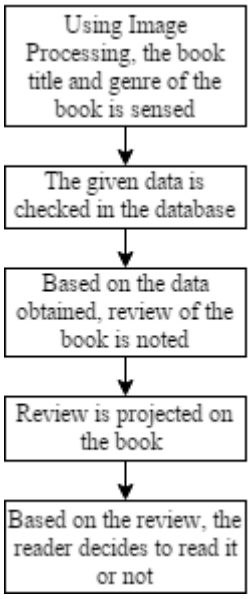

Figure 4 (b): Library Management System

Figure 4 (b) shows another example for Sixth Sense in a library environment. Camera captures the image of a particular book and sends it to the processor. The processor recognizes this book and then obtains a review of the book that has been given by past readers from the database. This review is then displayed on the cover of the book via the projector. Students can read this review and decide whether the book will be helpful or not.

3.4 Student Attendance

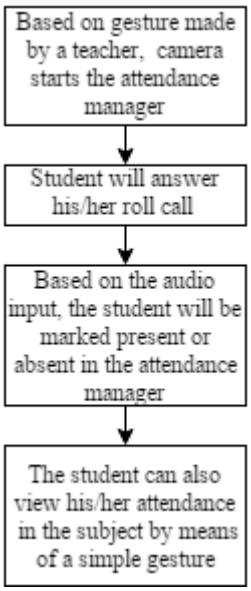

Figure 5: Student Attendance

Think about how attendance is managed currently. Teachers shout out names and mark a student as present or absent. If Sixth Sense is applied to this process, it may turn out to be easier than you could ever imagine. The teacher acts out a gesture, say 'A', which is identified by the marker. This instructs the processor to start the attendance system. An audio system picks up voice signals as students call out their numbers and mark the students as present respectively. Also, if the student wishes to check his/her attendance, he can act out a gesture, say 'C', and the system will display relevant information. Fig. 5 shows this process.

3.5 Notice Display

Consider the use of Sixth Sense in displaying notices in a college. If the student wants to view any notice, he can perform a gesture, say 'N', which will be picked up by the markers. This leads to the processor retrieving notices from a database and collecting useful information regarding the same. The projector then displays a list of notices from which the student can select the one that s/he wants to view. The selected notice is then displayed on a surface. Figure 6 shows this process in the form of a flow graph.

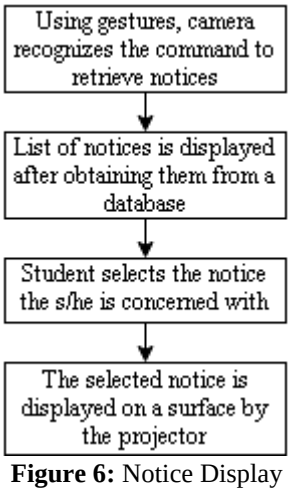

Figure 6: Notice Display

4. Future Scope

Before discussing the future scope of any technology, it is pivotal to have knowledge of its past and present implications. Pertaining to the Education System, Table 1 below shows the comparison between the present scenario and what it would be if Sixth Sense was applied to it.

Table 1: Comparison between Present Scenario and Sixth Sense enabled Scenario

Sr. No.	*Factor*	*Present Scenario*	*Sixth Sense enabled Scenario*
1	Classroom	Traditional board-chalk teaching approach	Instantly accessible data over the Internet, visually enhanced learning
2	Student Information	Waiting in queues at college office, prone to errors made by administration staff	Instantly updated by student, easily accessible
3	Library	Time consuming process of searching for required books and their reviews	Information about any book is available within seconds, as soon as the camera recognizes the book
4	Student Attendance	It involves teachers calling out names and students consequently getting their respective attendance marked	With the help of an audio recorder, all the teacher would have to do is start the system, and Sixth Sense would do the rest
5	Notices	Keep going to and checking the notice board from time to time, with the risk of missing out on some notices	Get copies of any notice and related information by making just a single gesture, with no risk of missing out, as all notices would be saved in a database

Sixth Sense is gradually emerging in the field of technology as one of the major developments in the field of Augmented Reality. Advantages of Sixth Sense include the following:

- It has immense potential to merge the physical and digital world and proceed towards advanced Human-Computer Interaction,
- It has scope for further developments – as new implementations of Augmented Reality are thought of, Sixth Sense, which is a part of it, will have new applications too,
- With an easy-to-use and easy-to-handle device, Sixth Sense is an all-in-one device that can be used for communication, data retrieval etc.,
- With the amount of time that the Sixth Sense device saves, as also shown in our examples pertaining to the Education System, it turns out to be an extremely efficient technology [5].

It is these advantages of Sixth Sense that makes it an easily understandable and implementable technology. Although it has many benefits to justify its superiority, there are still a lot of aspects regarding Sixth Sense that need to be worked on in the future. The existing device can be turned into a mobile-like handheld model, where in the projector and camera is placed as part of the same hardware layout; more attention can and must be paid to security in this technology.

5. Conclusion

Sixth Sense technology interprets the objects around us and helps us in accessing useful data anywhere, at our own convenience. It eliminates the use of obsolete electronic gadgets that could not keep up with the pace of science and innovation.

Implementation of Sixth Sense technology will not only impact the Education Sector and the process of learning, making it more interactive, but also bring about a tremendous enhancement in the field of entertainment, medicine etc. It may also be possible to use Sixth Sense as the fifth sense for handicapped [6].

With continuous technological advancements, Sixth Sense technology will soon become widespread amongst the majority electronics users. With Sixth Sense coming into the picture, it will be an all new era in the field of Augmented Reality, Artificial Intelligence, and computing and technology as a whole.

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