

# Sixth Sense - A Wearable Gestural Interface

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**Abstract:** The Sixth Sense is a wearable gestural interface that augments the physical world with digital information and lets us use natural hand gestures to interact with that information. The Sixth Sense technology bridges the gap between the physical world and the world of data. This paper provides a simple yet analytical approach towards the sixth sense technology which was originally introduced at MIT Media Lab by Steve Mann in 1994 and 1997 (head worn gestural interface), and 1998 (neck worn version), and further developed by Pranav Mistry (also at MIT Media Lab) by the name of a gadget called "WUW" (Wear yoUr World), in 2009.

**Keywords:** Sixth Sense, gestural interface, MIT, augment.

## I. INTRODUCTION

We humans have five natural Senses which we use to interact with the surrounding environment or the physical world and perceive information, this information helps us to make decisions and take the right actions. 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 [5].

The Sixth Sense is wearable gestural interface which bridges the digital world with simple gestures. The first Sixth Sense device was developed by Pranav Mistry at MIT media lab. Sixth Sense in scientific terms is defined as ESP (Extra Sensory Perception). ESP includes the information that is not gained through our natural Senses. Sixth Sense aims to integrate online information and technologies into everyday life. So it can help the human to make decision effectively [2].

Many hand gesture controlled techniques have been developed based on image processing. However, in such techniques the user moves hand in front of the camera, this paper deals with other technique wherein a simple wearable gestural interface containing an Arduino and accelerometer is used to sense hand gestures and Xbee is used to send the sensed gesture information to the Computer for controlling. In first part of the paper an example of a media player interface is introduced wherein the arduino is connected to Computer using NI LabVIEW Software. In second part, the Serial data from Arduino is converted into keypad commands for controlling the Computer.

## II. DEVELOPMENT IN SIXTH SENSE TECHNOLOGY

Sixth Sense technology (a camera combined with a light source) was developed in 1997 as a head worn device, and in 1998 as a neck worn object, but the Sixth Sense name for this work was not coined and published until 2001,

when Mann coined the term "Sixth Sense" to describe such devices. Mann referred to this wearable computing technology as affording a "Synthetic Synaesthesia of the Sixth Sense", believing that wearable computing and digital information could act in addition to the five traditional Senses. Ten years later, Pattie Maes, also with MIT Media Lab, used the term "Sixth Sense" in this same context, in a TED talk [5].

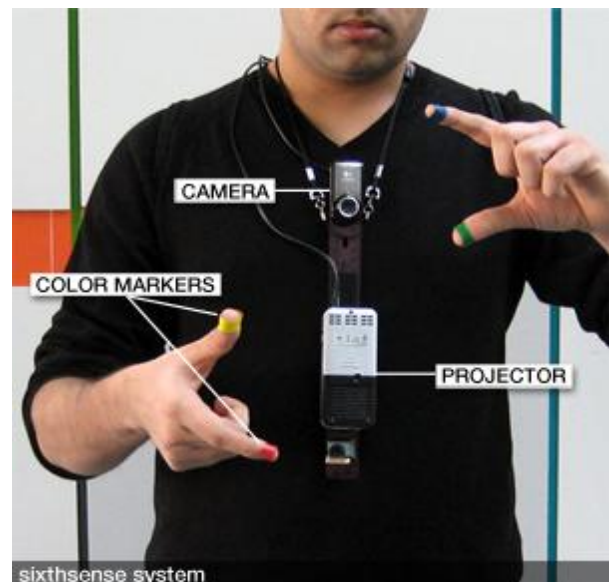


Fig. 1 The Sixth Sense Prototype by Pranav Mistry [5]

The SixthSense prototype, by Pranav Mistry is comprised of a pocket projector, a mirror and a camera as shown in Fig.1. 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 [3][4][5]. 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 coloured 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 SixthSense also supports multi-touch and multi-user interaction [5].

### III. IMPLEMENTATION

The Sixth Sense is any wearable device which allows us to interact with the digital world easily; it connects the physical world and digital world. The Sixth Sense wearable device introduced here consists of an accelerometer which senses the hand gestures and sends the sensed data to arduino board which processes the data and transmits it over Xbee, to the Computer for Controlling.

#### A. Arduino UNO

Arduino is an Open Source electronics prototyping platform based on flexible, easy to-use hardware and software. It is intended for artists, designers, hobbyists and anyone interested in creating interactive objects or environments. Arduino Uno is a board based on ATmega328 microcontroller [6]. It consists of 14 digital input/output pins, six analogue inputs, a USB connection for programming the on-board microcontroller, a power jack, an ICSP header and a reset button. It is operated with a 16MHz crystal oscillator and contains everything needed to support the microcontroller. It is very easy to use as the user simply needs to connect it to a computer with a USB cable or power it with an AC-to-DC adaptor or battery to get started. The microcontroller on the board is programmed using Arduino programming language and Arduino development environment [6].

Arduino is a tool for making computers that can sense and control more of the physical world than the desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs [6].

#### B. NI LabVIEW

Laboratory Virtual Instrument Engineering Workbench, popularly known as LabVIEW, is a system design platform and development environment for a visual programming language from National Instruments (NI). LabVIEW programs are called virtual instruments, or Vis. LabVIEW works on the principle of data flow. It is basically a graphical programming language in which the user can set up the program to manipulate and store data. There are three important components in LabVIEW programming: Front Panel, Block Diagram, and Icons and Connectors [7].

Front Panel is used to simulate the process or virtual testing area. It serves as the user interface (UI). Here, indicators and controllers are shown without any connection between these. We can control the action or simulate the process by clicking Run on the Tools bar. Block Diagram is used to program the process for the purpose of getting required or desired output. It contains the graphical source code that defines the functionality of the VI. Here, the programming method is graphical, so it is easy to understand, program and is less time-consuming. Icons are used as variables or controllers. These play a vital role in programming. These icons have predefined functions. Wires in LabVIEW are used to connect the input to the output [7].

#### C. LabVIEW with Arduino

Interfacing LabVIEW with Arduino is done through LabVIEW Interface for Arduino (LIFA) application. LIFA allows users to control sensors and acquire data through an Arduino using the graphical programming environment of LabVIEW. By utilising the processing power of LabVIEW running on a desktop computer with I/O and expandability of Arduino platform, users can create many applications. Tools required include Arduino board, Arduino IDE, LabVIEW, NIVISA and JKI VIPM [7].

#### D. ActiveX

ActiveX is a software framework created by Microsoft that adapts its earlier Component Object Model (COM) and Object Linking and Embedding (OLE) technologies. ActiveX is not dependent on Microsoft Windows, but in practice, most ActiveX controls require being run on Microsoft Windows.

Many Microsoft Windows applications including many of those from Microsoft itself, such as Internet Explorer, Microsoft Office, Microsoft Visual Studio, and Windows Media Player use ActiveX controls to build their feature-set and also encapsulate their own functionality as ActiveX controls which can then be embedded into other applications.

Here for playing the video on LabVIEW, an ActiveX Container is used with a Windows Media Player object, and can play any file type that is compatible with Windows Media Player [7].

#### E. Accelerometer

An accelerometer is an electromechanical device that measures acceleration of anything that it is mounted on. The accelerometer module used here is based on ADXL335 triple-axis (X, Y and Z) accelerometer. The sensor has a full sensing range of 3g.

#### F. XBee

XBee is the brand name of a family of form factor compatible radio modules from Digi International. The first XBee radios were introduced under the MaxStream brand in 2005 and were based on the IEEE 802.15.4-2003 standard designed for point-to-point and star communications at over-the-air baud rates of 250 Kbit/s.

The Xbee module used here is the XBee XB24-Z7WIT-004 from Digi. Series 2 (2mW antenna) which improves on the power output and data protocol. Series 2 modules allow you to create complex mesh networks based on the XBee ZB ZigBee mesh firmware. These modules allow a very reliable and simple communication between microcontrollers, computers, systems, serially. Point to point and multi-point networks are supported.

**IV. SIXTH SENSE PLAYER**

The Fig.2 shows the media player control of front panel of the LabVIEW. Here the Arduino, accelerometer and Xbee Setup is fitted inside the Hand glove for controlling as shown in Fig.3.

Windows media player object is used in LabVIEW for playing the video, any video file that is supported by Windows Media Player (.mpa, .mp2, .mp3, .avi, .wma, etc.) can be played.

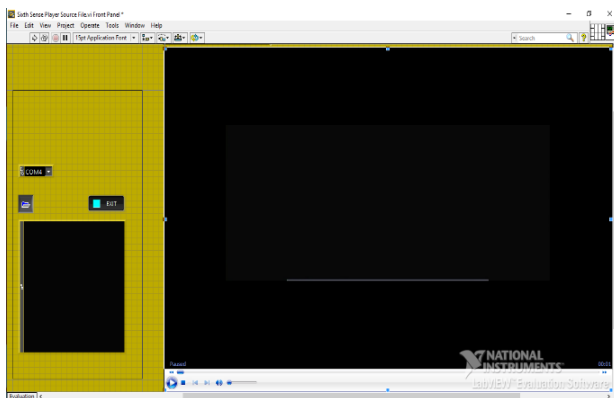


Fig. 2Front panel of LabVIEW

The accelerometer senses the hand gestures and sends the sensed data to Arduino which processes the data and transmits appropriate control command over Xbee. The Fig.3 shows the different controlling actions.



Fig. 3 Hand Gestures for Media player Controls

**V. SIXTH SENSE CONTROL FOR COMPUTERS**

Here a virtual keyboard is created using which the Serial data from Arduino is converted into keypad controls. The table below shows the different ASCII codes for key controls. These ASCII codes are converted to respective

key controls. Here Switches control are used with every motion for more gestures.

For each hand gesture sensed by accelerometer an ASCII code is assigned which is transmitted by arduino serially over Xbee. Here arduino is used as a keyboard with accelerometer.

TABLE I SERIAL TO KEY COMMANDS CONVERSION

Serial to Key conversion		
Serial Command from Arduino (ASCII)	HEX Code	Respective Key Commands
a	61	UP
b	62	DOWN
c	63	LEFT
d	64	RIGHT
e	65	PAGE UP
f	66	PAGE DOWN
g	67	ENTER
h	68	ESC
i	69	HOME
p	70	END
q	71	A
r	72	B
s	73	C
t	74	D
u	75	E
v	76	F

The Table 1 shows the ASCII and hex codes and the respective key commands

**A. Sixth Sense Gaming**

Simple example of a gesture controlled car racing game is shown in Fig.4. Here arduino and accelerometer is used for different controlling actions for the car such as boost, turn left, turn right, etc.



Fig. 4Hand Gestures for Gaming control

**VI.APPLICATION OF SIXTH SENSE**

The Sixth Sense 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. Sixth Sense also recognizes user's freehand gestures (postures). The Sixth Sense system also augments physical objects the user is interacting with by projecting more information about these objects projected on them.

## VII. FUTURE SCOPE

The system can be further extended to by adding more gestures for better control. A projector can be used as in the original sixth sense prototype developed by Pranav Mistry. So that the control can be extended anywhere and in future any digital system can be controlled with simple hand gestures anywhere.

## VIII. CONCLUSION

In this project a simple approach towards Sixth Sense technology has been introduced. However, the Sixth Sense can be considered as the future of Augmented Reality. The sixth sense has highly connected the physical world with the digital world. Sixth sense is developed to seamlessly integrate information into reality. The future may depend upon this sixth sense. The proliferation and the use of this technology is immense. The advantage of this technology is portable, Its cost effectiveness and data can be accessed from the machine directly in real time.

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## BIOGRAPHY



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