

# 3D HCI: An Human Computer Interface System using 3D Leap Motion Camera

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**Abstract:** In last few years, many researchers and organizations are interested to provide more natural, human-oriented means of interacting with computers. A particularly vital field of that trend is hand gesture recognition. These systems have received great attention in the recent few years because of their countless applications such as gaming, robotics, education, physical therapy etc. In this paper we present our implementation of using a motion controller to control the motion of a robot via simple human gestures. We have used the Leap motion camera and robot is connected to the ground station and the Leap is connected to the ground station via USB port. The Leap Motion Camera recognizes the hand gestures and relays it on to the ground station. The ground station runs the software for interaction with the robot in order to convey the simple hand gestures. In our implementation, we have written codes to interpret the hand gestures captured by the LEAP Camera, and transmit them in order to control the motion of the robot. Also we present our implementation in the field of gaming in which we are going to control the game with the help of hand gesture.

**Keywords:** Hand gesture recognition, HCI, Leap Motion Camera, Robotic ARM

## 1. Introduction

Gestures play a vital role in human communication. It has been found that gestures presents an appealing way to interact with computers as they are natural part of body. Gesture includes movement of body parts like hands, face, head, or other parts of body to express an idea or feeling.

Gesture Recognition enables humans to communicate with machine and interact naturally without any physical devices. With help of gesture recognition we can point a finger at the TV screen so as to change the channels without using remote or any other device. Gesture recognition is widely used in applications involving interaction between human and robot.

Human Computer Interface is interaction between human and computer. Basically HCI is a technology which reveals the study of how human can interact with computer. HCI has wide range of applications in the field of computer science, psychology, communication, education and design (graphic and industrial). HCI mainly focuses on user's working with computer irrespective of other kinds of machines.

3D technology has gained significant importance in the world of research. Leap motion controller is equipped with infrared stereo cameras as tracking sensors. The Leap motion camera captures image of hand movements performed in front of it and these images can be used for controlling various applications. Leap motion is user-friendly. It simply consists of 2 cameras and 3 infrared LEDs with help of which it is able to track infrared light with a wavelength of 850 nanometers.

## 2. Existing System

### 1) Specialized Glove

Specialized Glove technique is basically based on man-machine interface. This technique uses sensors to analyze data. The analyzed data is then processed by machine learning technique. SVM (Support Vector Machine) is used as a classifier so as to yield more accurate result. The best classifier achieved the sensitivity equal to 98.32%. [1]

### 2) Skin Filtering Technique

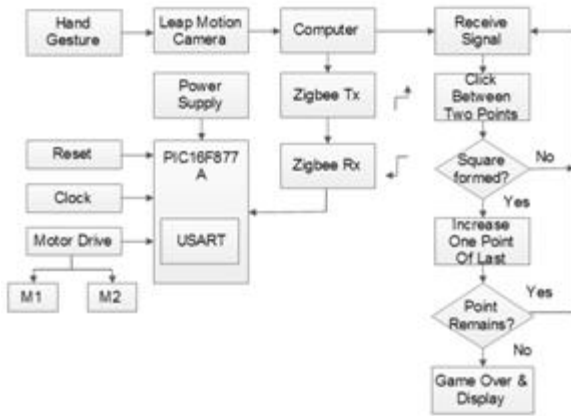
As existing system overcomes the use of gloves, it does not require any special device or mark, and users are free to move their hands in front of the camera. For hand region segmentation, system adopt dense optical flow for the whole captured frame and constructed a skin filter with a narrow ribbon to eliminate the influence of a complex background and other skin-colored regions [2]. The existing system performs hand region segmentation in complex environment by using dense optical flow and skin filter. It uses effective method for fingertip detection without actually coloring the finger.

### 3) WTA code based sensor fusion algorithm

Also in some systems whenever the user needs to interact with any electrical gadget, he has to raise hand with open fingers in front of camera. To stop the controlling action user needs to make a fist due to which the system goes to standby mode. In addition to this, if the user wants to continue then he needs to activate the system again. [3]

## 3. Proposed Method





**PIC16F877A:**

The PIC microcontroller PIC16F877A is one of the most prominent microcontroller. Coding of this controller is easy. We can erase code many times because FLASH memory technology is used in this microcontroller. It has total 40 pins and there are 33 pins for input and output. PIC16F877A used in many fields like home automation, industrial instruments and sensors. It is easy to handle and cost efficient.



Our proposed system is divided into two parts:

**A. Hardware**

**Robotic ARM**

Robotic arm is a type of mechanical arm , usually programmable with similar functions to human arm .The links of search a manipulator are connected by joints allowing either rotational motion or linear displacement. The links of the manipulator can be considered to form a kinematic chain .[5]



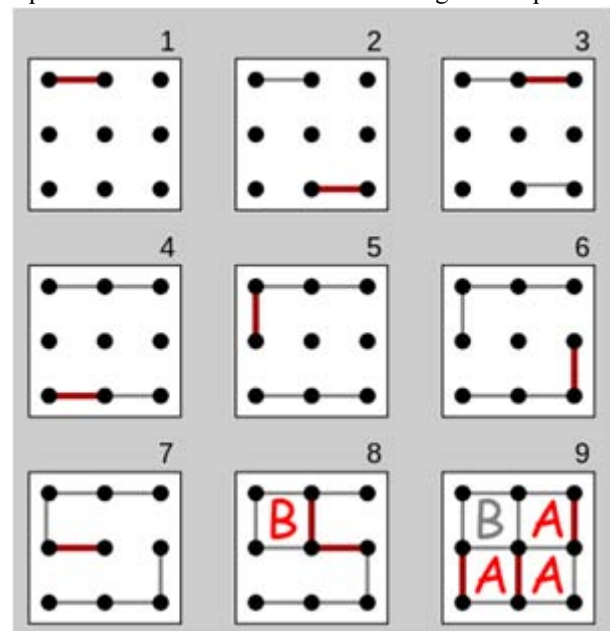
**Working**

Human performs the hand movements in front of leap motion camera. Camera will capture the hand movements and generate the appropriate signals which would be send to the computer . In proposed method we have used zigbee transmitter and receiver so as to receive the signal from computer and forward it to PIC16F877A which would in turn control robotic movements.

**B. Software**

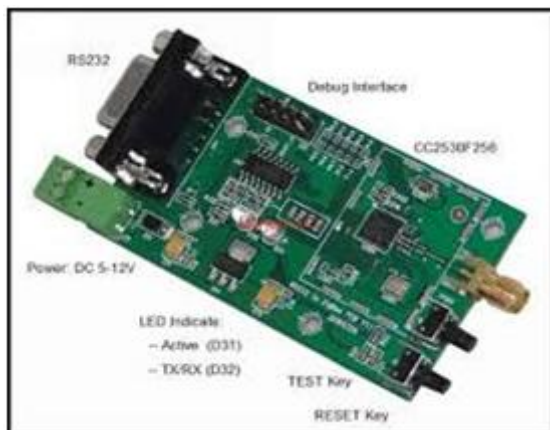
**Game Application**

Dots and Boxes is pen-paper based game. This game requires at least two players . Also it can be played by more than two players. Players starts game with empty mesh of dots and one by one add single horizontal or vertical line between two adjacent dots which are not joined. If the player's move completes fourth side of a box then it will gain one point.



**Zigbee**

Zigbee is low cost, low powerIEEE 802.15.4 standard for a suite of high-level communication protocols used to create personal area network with small, low-power digital radios[4]. Zigbee technology is much simpler than other wireless personal area network like WiFi or bluetooth.



By earning one point the player takes another turn. One who has more points is the winner of the game. The game ends when there is no place to put a line. Instead of using pen and paper for playing game, we can play this game on computer. To make this game more interactive we are providing 3D

interface by playing the game using hand gestures.

#### 4. Future Scope

The proposed system has been used to implement a simple game. The future research can proceed with implementation of more exciting and interactive game. Moreover , robotic arm can be improved so as to perform hard man labour automatically .

#### 5. Conclusion

Thus, we have presented a method to recognize the unknown input gesture .We applied this system to recognize the single gesture. Our system is also able to handle complex environment efficiently. Using this model we are able to handle software and hardware application using hand gesture .

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