

Human Computer Interaction Where Controlling Computer and Applications Through Image Processing and Voice Recognition

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Abstract

Developing new intuitive and more natural interfaces is one of the biggest challenges in human computer interaction. Currently computer is strongly tied to the high resolution pointing devices. This provides two dimensional discrete inputs to the computer system. This is current standard interface in personal computers. While the working of such devices in today's interfaces cannot be denied, but there are opportunities to use various other sensing devices like video camera and micro phones for giving input to the computer through hand gestures and voice commands. image processing techniques such as image segmentation, gesture recognition and using voice recognition, to control mouse actions and other application actions like zoom in, zoom out, volume up volume down, play, stop, next, previous, etc. this technique can be used to control applications like Media Player, Maps, Power Point Presentation, Games, image viewers and many more. Recognition and pose estimation in this system are user independent and robust because use of colour tapes on finger to perform actions makes it easier to detect the fingers and recognize the gesture.

Keywords

HCI (human Computer Interaction), Gestures, Mouse Control, Voice Control

I. Introduction

Presently Computing Devices are strongly connected with high end pointing devices which require higher resolution but in return we get discrete two dimensional controls. This is effective in a use of various computer applications which requires two dimensional input data. But using mouse and keyboard require more human efforts and more space. While strong presence of such input devices can't be denied but there are other ways to apply other kind of input like we can use video camera and image processing techniques to capture user input and present it to the computer. Such approach will make human computer interaction more natural. Our project, 'Human Computer Interaction Where Controlling Computer and Applications Using Image Processing and Voice recognition' is an attempt of such approach.

In our project we are going to use colour tapes on fingers. And using video camera we will detect the hand gestures. And those colour tapes will us in it. Colour tapes are easy to detect through various image processing algorithms. The hand gestures can be used for mouse movements and basic gesture operations. While we use voice recognition to perform basic commands like search, shutdown, restart, refresh.

II. Related work

A lot of research is being done in the fields of Human Computer Interaction (HCI) and Robotics. Researchers have tried to control mouse movement using video devices for HCI. However, all of them used different methods to make mouse cursor movement and clicking events.

One approach, by Hojoon Park [1] used index finger for cursor movement and angle between index finger and thumb for clicking events. He showed that we can use angle between finger and thumb for clicking events [1]. But in his system there was a problem when the finger shook a lot. Since He used real-time video, the Illumination changes every frame. Hence the position of the hand changes every frame. Thus, the fingertip position detected by convex hull algorithm is also changed. Then the mouse cursor pointer shakes fast [1].

One another approach is by Robertson P., Laddaga R., Van Kleek M. [3] which is Virtual mouse vision based interface, January 2004 [3]. Their solution was to develop a virtual mouse that enables

users to control the kiosk with hand signs and movements. The kiosk has a standard visual user interface, with arrow cursor to indicate pointer movement.

The arrow pointer is the only feedback the user gets as to where the user is pointing. The user can use that feedback, adjusting to imperfections in tracking, without the distraction of a distinct and different other signal [3]. The System was not capable for complex operations and it cannot control high end system and applications which lowers its scope.

III. OUR system

In our system, 'Human Computer Interaction Where Controlling Computer and Applications Using Image Processing and Voice recognition' is an attempt in more natural computer interface and operating capability. Here, we will be placing coloured tapes on our fingers. Each tape is associated with different functions like one of the tape will be used for controlling cursor movement while the presence and distance between the two coloured tapes will be used for click events of the mouse. And one tape we are using for gestures Also, we will be enriching our system with voice recognition capability to perform basic actions like shutdown, search and surfing thus, the system will provide a new experience for users in interaction with the computer.

We introduce an effective way of Human Computer Interaction where the proposed system has following features

- Controlling the Mouse Movements through Hand Movements.
- Controlling Application like Media Player, Games, Maps, Image Viewer.
- Perform Basic Operations through Voice Recognition like Search, Shutdown, Restart, etc.

A. System Architecture

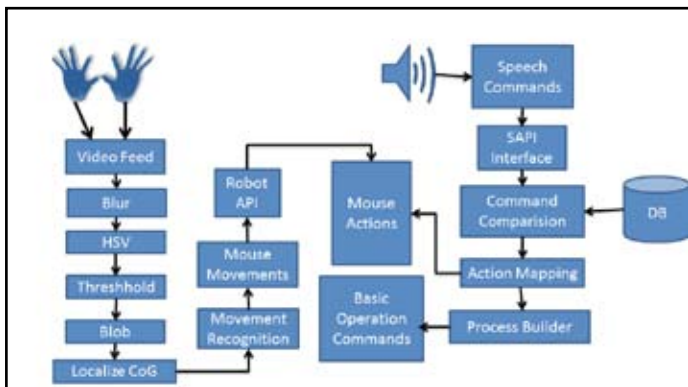


Fig. 1: System Architecture

In the system first the video will be grabbed then we will apply blurring on the grabbed frame to reduce noise. Blurred image is in RGB colour model then to get the better complete description of the colour we will convert it in to the HSV colour model. Then we will apply the Thresholding according to the colour tapes we are using. The threshold image then used to detect blob where we are applying blob detection algorithm. We will find the Centre of those blobs and recognize the blob movements and that movement can be used to move mouse and perform other mouse operations. At the same time the Speech commands are processed using SAPI interface. Extracted commands through SAPI are compared with the commands saved in database and according to it the actions are performed using process builder. We are using Robot API to perform various keystrokes to the computer system.

B. Functional Requirements

Table1: Functional Requirements

Class	Function	Requirement
Color_Tape_Detection	Color_ Extraction	HSV Color Detection Algorithm
Color_Tape_Detection	blob_ Extraction	Blob Detection and Classifier algorithm
Color_Tape_Detection	Cursor_Move	Mapping Cursor Control Algorithm, Weighted Speed Cursor Control Algorithm
Voice_Recognition	Voice_Recognise	Dynamic Time Wrapping Algorithm

We are using Image Processing techniques which involve various algorithms. Hence there are some functional requirements. As shown in table 1 classes are included which are associated with functions.

1. Class Color_Tape_Detection has Color_ Extraction function which requires HSV colour detection algorithm. Use of HSV colour model will help to extract the colour tapes from the fingers and that will give robustness to our system
2. Class Color_tape_detection also have blob extraction function we require blob detection and classifier algorithm to detect the blob. Blob is a set of pixel. When we do the thresholding on the HSV converted image according to the threshold value (we get it from the colour tapes we are using). Threshold

image separates the background and foreground where the blob is detected.

3. Class Color_tape_detection also have one more function that is Cursor_move. Here cursor control algorithm is required which moves the mouse according to movements of blobs. Here Centre of graph is calculated from the blob. And according to that centre of mouse is moved. Here is a problem, when we move our hands the cursor can't be at one place constantly there are various distortions hence to reduce it we use Weighted Speed Cursor Control Algorithm.
4. Class Voice_recognition as system possess the voice recognition capabilities we require to detect the voice commands hence SAPI interface is added to get the Voice Commands and those commands are added to the process builder to perform the various system operations to do this we are using Dynamic Time Wrapping Algorithm

IV. Functional Blocks

In our Proposed System We Have 2 Main Blocks.

- A. Gesture Recognition Module
- B. Voice Recognition Module

A. Gesture Recognition Module

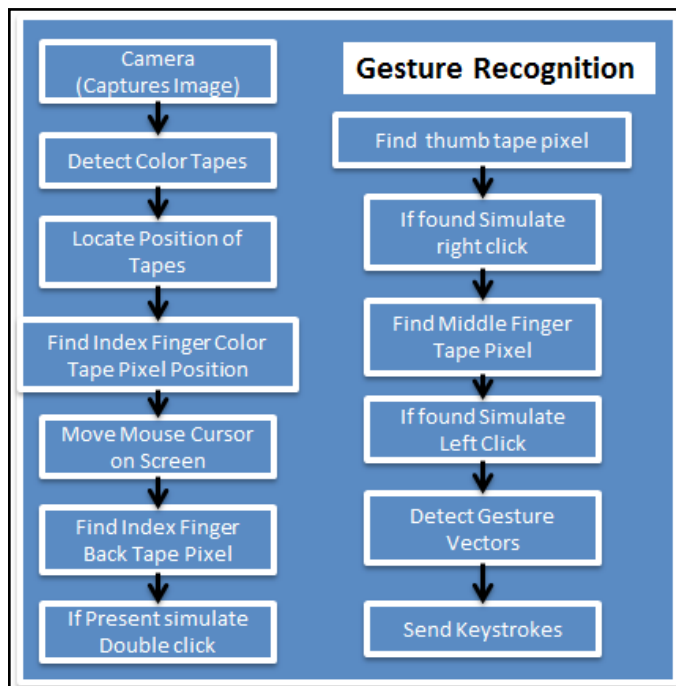


Fig. 2: Gesture Recognition Module

In gesture recognition block camera captures the image. First task is to detect the colour tapes. Now position of colour tapes is located. Index finger is used for the cursor movement hence index finger colour tape position is detected and according to it the movement of cursor is done. Now index finger back pixel is checked if index finger back tape is detected then system will simulate double click. Now if thumb pixel is detected then the then system will perform single click. Ad if the system found middle finger colour tape then it will simulate left click. At the same time if gesture is detected then system will perform the operation associated with gesture and will send keystrokes according to it.

B. Voice Recognition Module

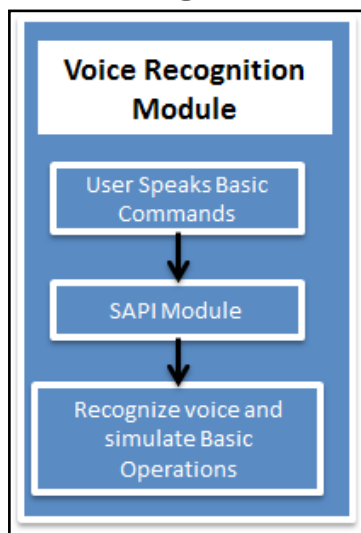


Fig. 3: Voice Recognition Module

As we are using voice commands we require voice recognition module where user speaks commands and SAPI module process those commands and then system simulate the basic operations according to the commands.

V. Operation Illustration

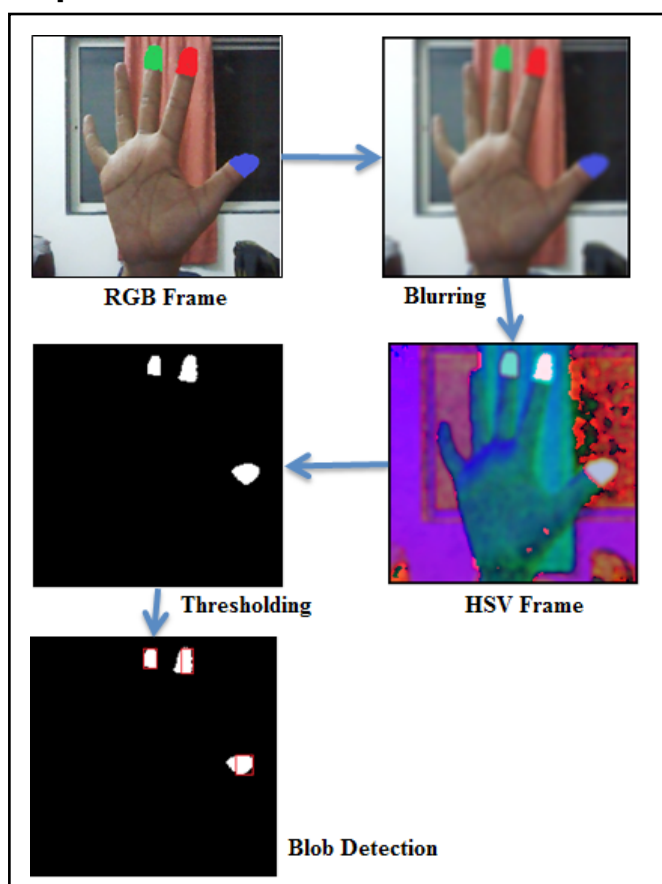


Fig. 4: Actual Image Processing On Grabbed Frame

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