ABSTRACT

Human gestures are the way to express or communicate. Idea of Hand Gesture Recognition System is to promote the users from special category, those who can’t handle traditional input devices as well as for normal users. This system will enable handicap users to operate computer system till some extent skipping mouse and keyboard. Users will be trained to perform some predefined gestures in order to operate Hand Gesture Recognition System. This paper focuses on the building block and key issues to be considered in HGRS and our contribution in the development of HGRS. The primary goal of the project is to create a system that can identify human hand gestures and use it for performing different functionalities. In this paper, an attempt is made to building a richer bridge between machines and humans than primitive text user interfaces or even GUIs (Graphical User Interfaces), which still limit the majority of input to keyboard and mouse. Hand Gesture Recognition System enables humans to interface with the machine (HMI) and interact naturally without any mechanical devices. This could potentially make conventional input devices such as mouse, keyboards and even touch-screens redundant.

I. INTRODUCTION:

Gesture Recognition is a topic in computer science and language technology with the goal of interpreting human gestures via mathematical algorithms. Gestures can originate from any bodily motion or state but commonly originate from the face or hand. Current focus in this paper is Hand Gesture Recognition.

Computer recognition of hand gestures may provide a more natural human computer interface, allowing people to point, or rotate a CAD model by rotating their hands. Interactive computer games would be enhanced if the computer could understand players’ hand gestures. Gesture recognition may even be useful to control household appliances. We distinguish two categories of gestures: static and dynamic. A static gesture is a particular hand configuration and pose, represented by a single image. A dynamic gesture is a moving gesture, represented by a sequence of images. We focus on the recognition of static gestures, although our method generalizes in a natural way to dynamic gestures. Controlling computers via hand gestures can make many applications more intuitive than using keyboard or even mouse input. Since desktop cameras are becoming standard workplace equipment (e.g., for video conferencing), using those cameras for hand gesture recognition does not require any additional hardware. Finally, public information kiosks could use this technology to solve hygienic and input device wear problems. We are using white wrist band & static black background as shown in Fig.1 to limit the freedom and achieve maximum accuracy as compared to other systems.

Figure 1: Snapshot of human hand wearing a white wrist band with black background. Following table shows the existing system performance and criteria.

Figure 2: Table showing existing gesture recognition systems found during research.

<table>
<thead>
<tr>
<th>Paper</th>
<th>Primary method of recognition</th>
<th>Number of gestures recognised</th>
<th>Background to gesture images</th>
<th>Additional markers required (such as wrist band)</th>
<th>Number of training images</th>
<th>Accuracy (%)</th>
<th>Frame rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Bauer &amp; Hienz, 2000]</td>
<td>Hidden Markov Models</td>
<td>97</td>
<td>General</td>
<td>Multi-coloured gloves</td>
<td>7-hours signing</td>
<td>91.7%</td>
<td>-</td>
</tr>
<tr>
<td>[Starner, Weaver &amp; Pentland, 1998]</td>
<td>Hidden Markov Models</td>
<td>40</td>
<td>General</td>
<td>No</td>
<td>400 training sentences</td>
<td>97.6%</td>
<td>10</td>
</tr>
<tr>
<td>[Bowden &amp; Sachadi, 2000]</td>
<td>Linear approximation to non-linear point distribution models</td>
<td>26</td>
<td>Blue screen</td>
<td>No</td>
<td>7441 images</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>[Davis &amp; Shah, 1994]</td>
<td>Finite state machine / model matching</td>
<td>7</td>
<td>Static</td>
<td>Markers on glove</td>
<td>10 sequences of 200 frames each</td>
<td>~98%</td>
<td>10</td>
</tr>
</tbody>
</table>
1. RELATED WORK

i. Orientation Histograms

Freeman and Roth

It is for hand posture analysis. It Creates histograms of local orientation using feature vectors from pixel intensity Recognizes 10 gestures in real time [7].

ii. TV Controller

Freeman

Uses one open hand to control onscreen display. It’s a Real time application and Hand may not be prominent in image.

2. OUR APPROACH

On the basis of use case diagram as shown in fig.6 the Hand Gesture Recognition System module have been decided to be implemented in four stages using JAVA [1]. We selected JAVA since it is a pure Object Oriented language, portable and we were aiming for a implementing a real time system robustness. JMF Java Multimedia Framework is newly introduced package that supports from jdk1.5 onwards. It provides in built class that implements functionality to access hardware like video and audio capturing devices, also there is a scope of various format and specification for configuring capturing schemes. We have used JMF for webcam operation.

3. MODULES AND DESCRIPTION:

There are basically four modules in our complete project and they are as follows:

- Capturing Image
  This is the first task of HGRS, the task deals with the capturing of still image with the help of the inbuilt java packages (JMF) and stores it in a predefined location in a prescribed format. Image capturing will be done continuously like video streaming.

- Processing Image
  The second module deals with processing the captured image. Image is being captured automatically once the system is booted, for capturing we have used JMF [3]. Once the image is captured then it is converted it into a gray scale...
image and then into a binary image so that gesture recognition task will be simplified. Filtering is being applied for removal of noise, 3x3 matrix filter is being designed for removal of noise from the binary image.

4. TECHNICAL FEATURES
The Hand Gesture Recognition System will facilitate all the My Computer operations to be performed through Hand gestures. The various operations that will be supported by this system are as follows:

• To Select a particular Drive, Folder
• To View a particular Drive, Folder
• Back and Forward Functions
• Refresh
• Create Folders
• Delete Files and Folders
• View properties of Files, Folders
• Edit operations (cut, copy, paste, select all)

5. CONDITION FOR SUCCESS:
Gesture performed under any condition can work very rarely as light illumination and the accuracy in performing gestures varies with different users. With
constant background and a level of light this system is assumed to work properly. Image capturing device i.e. web cam is one of the major component that affect the accuracy for images. We recommend any web cam at least VGA type with 320X240 resolution. No light [flash light] required. Distance from camera is limited to 2-3 feet in straight. For testing purpose black background and white wrist band is required.

6. RESULTS AND REFINEMENT
Till date we have completed image capturing module and filtering for noise including conversion of captured coloured image to binary image. Effect of surrounding light intensity and hand generates moderate changes in binary image. Various filters are applied to rectify noise and refine the binary image quality, thus making detection task easier. Once binary image is extracted from the colour image then it applies the Hand algorithm in which first of all with help of wrist band which is the reference point in the binary image a square is been drawn to find out total number of edges in the binary image . The total number of edges find will be divided by two to find out number of fingers present in the captured image. Once the number of fingers gets identified the using hand algorithm the gesture performed is matched with the predefined gesture. If the gesture performed is identified then with the help of third party class called java native interface we will be accessing system functions and if not then the image will be discarded and the webcam will capture a new image and following above four modules will be implemented. System is going to implement multithreading which will make the system fast and simultaneous actions can be performed implementing a real time Hand Gesture Recognition system.

7. ADVANTAGES
- The Hand Gesture Recognition system provides a natural way of interfacing with the computers; hence it is more User friendly.
- It provides a better computer interaction environment for the physically handicapped users.
- There is less wear and tear of the computer as the standard input devices are eliminated and a camera is used as an input device.
- Carpel-tunnel syndrome is increasing because of the repetitive use keyboard and mouse. Since this system does not use either of these as input devices it proves to be a healthier way of interacting with the computers.
- As performing gestures is human action; variations are considered till 30% tolerance. Single gesture can perform action that may require sequence of key strokes, thus helping to increase usability of system.
- Used in operations. Gurion University of the Negev (BGU) in Israel have developed a new hand gesture recognition system, tested at a Washington, D.C. hospital, that enables doctors to manipulate digital images during medical procedures by motioning instead of touching a screen, keyboard or mouse which compromises sterility and could spread infection.

Figure 10: "A Gesture-based Tool for Sterile Browsing of Radiology Images"

8. DISADVANTAGES
- Such systems are difficult to develop because of the complexity and the cost of implementation.
- As each gesture is assigned a specific control command, this system is not platform independent since certain control commands vary as the operating system varies.
- Though Hand Gesture Recognition System is developed in JAVA it is not fully platform independent.

9. FUTURE ENHANCEMENT
- The system can be further enhanced to include functions with the help of which it would be possible to handle other software’s (e.g. MSWORD, MSACCESS, etc) through gestures.
- We can also enhance this project such that it can translate hand gestures to Power Point commands.
- Removal of wrist band and considering another reference point and also removal of black background.
- Mobile Devices, More user studies.

10. CONCLUSION:
Gesture recognition is complicated process, as input to system cannot be determined. Using various concepts of image processing and fundamental properties of image we tried to perform this task. Success of Hand Gesture recognition system depends of end user as well as the consideration of complexity level in image processing. Currently we are living in Touch generation with implementation of Hand Gesture Recognition System for special users as well as for normal users by eliminating the traditional input devices we are going to enter into the world of Gesture Recognition Generation.

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