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Visual Keys

Ruturaj Patole[1], Akshay Pawar[2], Trushant Pisal[3], Vitthal Sable[4] , Prof.S.A.Tiwaskar[5]

Student, Department Of Computer Engineering, Vishwakarma Instititute of Information Technology Pune,
Savitribai Phule University, Pune, India[1, 2, 3, ,4,5]
Email: ruturajpatole@gmail.com[1],akshayspawar50@gmail.com[2], trushant.pisal@gmail.com[3],vitthalsable181094@gmail.com[4]

Abstract - While interacting with computer traditional input methods like keyboard and mouse become problematic for elder and physically disabled people. They are not comfortable for disabled people. According to census of India about 20.3% of disabled people are movement disabled and disabled population increased by 22.4% between 2001 and 2011.So we need to invest much more in providing different input method for such people. This paper presents visual key based system by providing different input methods to interact with computer and it also allows managing electronic devices through computer.

Proposed visual key system provides various input methods like finger movement, speech input and mouse input. In finger movement the system will detect the position of fingertip of user and map it with onscreen keys to detect which key is pressed to access the computer. Another way is speech input where user's speech is taken as input to access computer application. The system will also provide keys to control electronic devices through computer to reduce physical interaction with the device by providing promising interface between human and computer. The proposed framework for visual key system will be beneficial to user with severe disabilities. From the work done by us it is identified that we can provide variety of input methods for disabled people which requires more technological support using their nature behavior, considering their limitations.

Index Terms- Human Computer Interaction, Image processing, fingertip detection, computer vision, Speech Processing.

1. INTRODUCTION

Normal people can access the computer and other electronic devices without putting much effort while interacting with computer. But when physically handicapped people are interacting with the computer they need to put extra efforts or sometimes it is not possible for them to interact with the system properly. In India around 20.3\% disabled population is movement disabled and majority of them are elder people and not every one of them can use traditional input systems such as mouse and keyboard. So aim of this project is to provide visual key based input system to user instead of traditional input system.

So to reduce efforts of physically handicapped people and to make system more accessible for them, the input methods for computer interaction should be more natural and comfortable and there should be minimal interaction with system. For handling electronics devices at home, physically handicapped people require assistant to handle the devices, this is not possible at every time. So there should be an easy method to interact with the electronic devices without anyone's assistant. So this paper presents such input system to user named visual keys.

2. EXISTING SYSTEM

2.1. *Camera Mouse*

This system is developed to provide computer access for people with severe disabilities [1]. The system tracks the computer user movements using video camera and translates them into the movements of the cursor pointer on the screen. Body features such as the tip of the user's nose or finger can be tracked. These provide a way to interact with the system using bodily feature to control specific task of the computer [1].

2.2. *Gesture Recognition*

Gesture recognition enables (Human computer Interaction) humans to communicate with the machine naturally without using any other mechanical devices[2]. Different gestures are used as input to control specific functions. For each specific operation different gestures are assigned. Different type of gestures can be used like sign language, particular body part movement etc. [2]

Ex. Sign languages:

Sign language is used as communication medium for deaf people to instruct computer for specific task.

2.3 Control Mouse

As computer technology is increasing day by day, electronic devices used by people are becoming smaller and they want to use them ubiquitously [4]. There is a need of new interfaces designed specifically for use with these smaller devices. We are recognizing the importance of human computer- interaction and in particular vision-based gesture and object recognition[4].We can reduce the work space required using vision technology and controlling the mouse by natural hand gestures.

3. PROPOSED SYSTEM

In this system user is provided with different input methods to interact with the system. After starting the system user have to select one of the input method to interact with the system. Input methods are given as 3.1 Using Fingertip 3.2 Using Speech 3.3 Controlling Electronic Devices.

3.1 Using Fingertip

In this input method user can use his fingertip for giving input to the system. Fingertip is easiest and natural way to interact with the system.

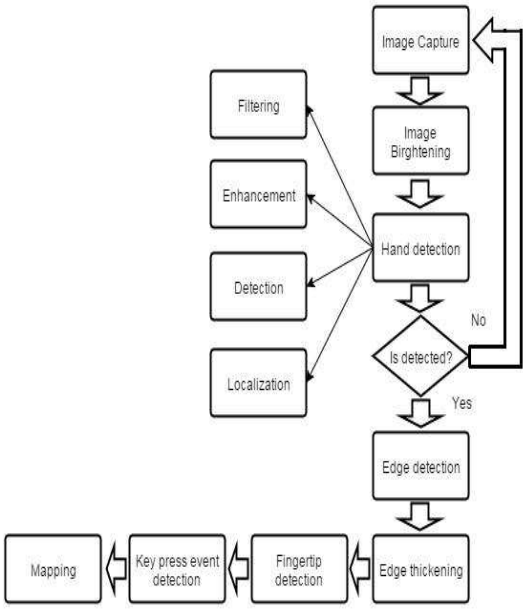


Fig 1. Fingertip Input

For detection of fingertip we use skin color as feature to detect hand. For detection of hand we use HSV color model as it is less sensitive to light as compared to RGB. Then we perform morphological operation to reduce the noise in the detected hand region. To detect the hand contour and fingertip location we use convex hull. The position of fingertip is used to map with different keys to interact with the computer and to access electronic devices. Using color as a feature hand can be detected with different hand positions.

3.2 Using Speech

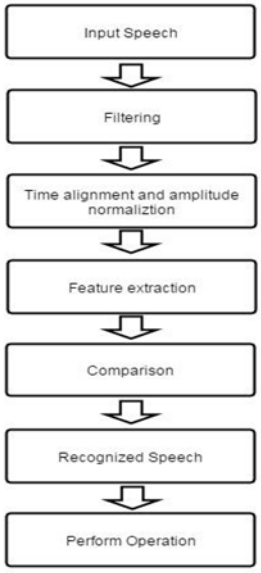


Fig. 2 : Speech Input

In this method user can interact with the system using speech. In this method we take speech as input from the user. Then we perform filtering to reduce the noise from the input. As different users have different voice strength we need to perform time alignment and amplitude normalization. Then we compare the input with the command to perform the operation defined for that command.

3.3 Controlling electronic devices

To interact with the electronic devices from computer we require transistor, relay, resister,

connector, battery to transmit the on/off signal to electronic devices through computer. Bellow figure shows circuit connection:

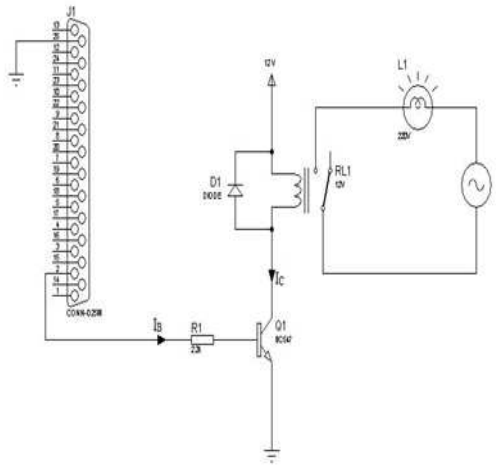
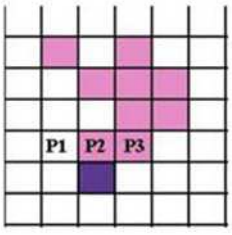


Fig .3 : Circuit Diagram

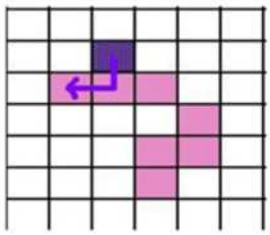
4. ALGORITHM

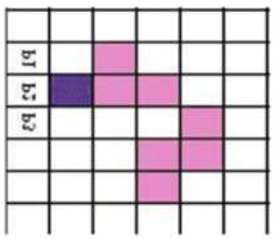
4.1 Algorithm to find contour

We use 'Theo Pavlidis' algorithm to find contours[5]. It works nicely on 4-connected patterns which the fore-arm contours are always bending to be. The algorithm begins with a start point. Locating a start point can be done by scanning each row of pixels from the bottom left corner. The scan of each row starts from the leftmost pixel proceeding to the right [5]. When a white pixel is encountered, declare that pixel as start pixel. After deciding the start point, there are 3 pixels which we are interested in. That will be P1, P2, P3 shown in Figure, P1 is the upper-left pixel with respect to the start. P2 is the upper pixel with respect to the start. And P3 is the upper-right pixel with respect to the start.



If P1 is black pixel and P2 as well, we check P3.If P3 is a white pixel, we declare P3 to be the next start pixel and move one step to your right succeeded by one step to your current left to l and on P2 as shown in Figure. The next P1, P2 and P3 will be changed according to the location and change of orientation [5].





If none of P1, P2, P3 are white pixels, the orientation will be rotated by 90 degrees clockwise while standing on the same pixel. Afterwards we do the same procedure all over again. If the orientation has been rotated 3 times continuously without finding any white pixel in P1, P2 or P3, it means that we have located an isolated pixel. The pixel is not connected to any white pixels. This situation will cause the algorithm to terminate.[5] When the search is finished, couple of contours can be found in the image. If the longest contour in the image is larger than a certain threshold, we choose the contour to be the one we are interested in.

4.2. Algorithm to find fingertips

This algorithm marks up the fingertips on the contour by computing the angle of each point [6].

Fingertip-Angle = (X-X1)(X-X2)/ | X-X1|| X-X2|

X1 and X2 are separated by X within the same distance. X1 is the previous point with a certain number of points before X. X2 is the following point with a certain number of points after X. The distance

is 20 points in our experiment. The symbol () means the dot product. The value of Fingertip-Angle is between 0 and 1. Angle of each point in the contour will be calculated [6]. We can notice that more accurate the angle is larger is the cosine value. So we can set a threshold for the cosine value, 0.6 in our experiment. Our next step is to choose a point in a group of continuous points [6]. This can be done by choosing the point which is the local maximum of the group.

5. CONCLUSION AND FUTURE SCOPE

We have proposed a framework for developing visual key system which will be beneficial to user with severe disability. Visual key system provides finger movement, speech input, mouse input to interact with system. Entered input gives quick access to applications and system function. Using this input user can also manage electronic devices through computer.

However, there are some challenges in developing this kind of system like variety of skin colors of human races which is the main issue in getting stable results, another is that most vision algorithms have illumination issues, if the vision algorithms can work in any environments then our system will work more efficiently. We can also combine this concept with augmented reality which is becoming more and more popular. We can use the hand features to locate the virtual objects and those objects can be interactive to the hand. So the virtual objects are not only shown in the video but also can also interact. Visual key concept can provide more comfortable and usable input system to the disabled user. Visual Key system can open new opportunity the disabled people.

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