Advance Processing Unit With Virtual Human Machine Interface

Ms.Triveni Paradkar
Department of Electronics and Telecommunication,
Dhole Patil College of Engg.,

Prof. Anil Wanare
Department of Electronics and Telecommunication,
DYPSOE, Lohegaon, Pune

***Abstract*— The proposed model bridges the crevice between the physical world and digital world. It uses natural hand gestures to interact with digital world in order to achieve simplicity. The objective is to access data from any machine at real time speed. The user does not require any machine-human interface to access the data. The data access through recognition of hand gestures is much easier and user friendlier compared to the text user interface or graphical user interface which requires keyboard or mouse. The application of this is in educational institute and industrial presentation. This paper finds the possible solution to interact with machine virtually for physically challenged and blind persons.**

Keywords: Gesture recognition, Hand gesture, Infrared vision, Java, Arduino, Human computer interaction

I.INTRODUCTION

Video projection is widely used for multimedia presentations. In such situations users usually interact with the computer by standard devices (keyboard, mouse). This kind of communication restricts the naturalness of the interaction because the control of the presentation keeps the user in the proximity of the computer. This prototype demonstrates an effective human-computer interface for a virtual mouse system in a projector-camera configuration. It would be more comfortable and effective if the user could point directly to the display device without any hardware equipment. Here proposed method interacts with the projected presentations or applications by hand gestures in a projector-camera system. For this purpose I use the image acquired by a camera observing the gestures of the speaker in front of the projected image. The system applies a colour marker to recognize poses of hand gestures. The virtual mouse-based application is controlled by the detected hand poses and the palm positions. The virtual user-interface can be displayed onto the projected background image, so the user controls and interacts directly with the projected interface realizing an augmented reality. The proposed model bridges the crevice between the physical world and digital world. It uses natural hand gestures to interact with digital world in order to achieve simplicity. The objective is to access data from any machine at real time speed. The user does not require multiple human machine interface device to access the data. The data access through recognition of hand gestures is much easier and user friendlier compared to the text user interface or graphical user interface which requires keyboard or mouse.

II. FUNCTIONALITY OF HAND GESTURE BASED REMOTE CONTROL

Utpal V. Solanki & Nilesh H. Desai from G. H. Patel College of Engineering and Technology, Gujarat Technological University Gujarat, India has proposed Hand gesture based remote control for home appliances. It uses real time image processing for hand gesture recognition in infrared vision using Blob scanner library and microcontroller development board & Arduino. This paper presents a novel system to control home appliances through hand gesture as a remote control device.

Gesture recognition solutions can be divided regard to the type of gesture used for controlling a computer. Gesture can be considered as a change of the hand position (hand movement) in a particular time interval with a given velocity or as a change of the hand shape (forming ellipse with thumb and the index finger). Gestures that belong to the first group are typically called dynamic gestures while there from the second group is often referred to as static gesture.

A. Software:

To implement the algorithm and its logic for run time image processing, a JAVA Processing environment is used. Processing is a Java based programming structure. To process the images, an open source image processing library under GNL GPL v3 license named as Blobscanner processing library is used, once the data or frame is taken from an infrared web camera. After having the image in software, code will find the hand based on skin detection algorithm. If nothing is available then system will be ideal but if hand part is detected then system will start implementing the gesture recognition algorithm on the image to recognize the gesture.

B. Hardware:

Camera used in Handmote prototype is a simple Webcamera.The exact modification did to the camera is shown in figure 2. Light spectrum contains visible light and infrared light as well. Aim is to use infrared spectrum, thus the IR stop filter is replaced with IR pass filter, that is why camera will not see the visible spectrum but only the IR light reflected back from hand as explain in figure 1.Now this camera will give infrared region images of environment to the software application.

To decode the data coming from software application and send it to the electronic gadget, it has used Arduino development board based on microcontroller Atmega328 from ATMEL.

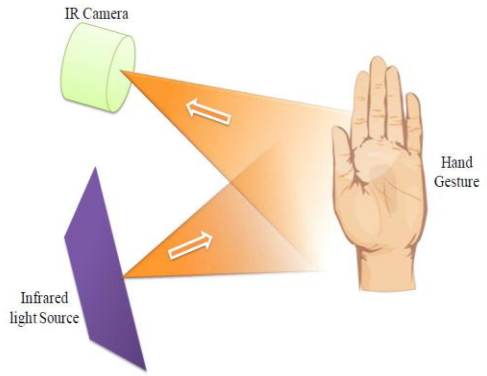

Fig.1. Camera and IR source setup

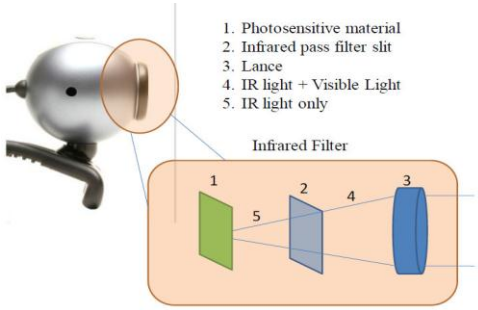

Fig. 2. Filtering of IR light

C. Algorithm:

First step after taking a frame from camera is to track the hand based on skin detection algorithm using Blob scanner library. Next step is converting the image into binary formand then edge tracing. Once this much part is ready or hand is present in image than application search for gesture behaviour by counting the number of fingers and its orientation. Angle between two successive fingers gives useful flow to recognize the hand gesture. Software application reference background frame stored in variable, and every time it compare with upcoming frames. Algorithm flow is shown in figure 3.

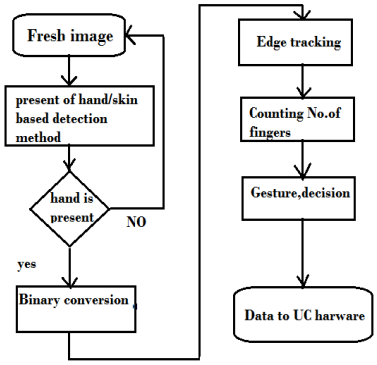

Fig.3. Application Algorithm

III. VIRTUAL MOUSE BASED ON HAND GESTURE

Xingfeng Wang, Kaihuai Qin from Department of Computer Science and Technology Tsinghua University Beijing, CHINA has proposed virtual mouse based on hand gestures in complicated background using CamShift (Continuously Adaptive MeanShift) algorithm, according to the skin colour is used to track the hand, and fingers features are used to recognize poses. Both the motion and poses of the hand are used for gesture understanding.

This paper focused on, the hand tracking and centroid calculation of a hand, the feature extraction method, the hand gesture understanding is described. It use an inexpensive USB webcam to capture 640*480 24-color images, and the CPU of PC is 899 MHz. The sampling rate of the USB webcam is 9.3 frames per second. With this algorithm, one frame needs 0.994 seconds averagely, and the recognition rate is about 85%.

IV.IMPLIMENTED SYSTEM

This methodology uses a camera , projector, laptop & colour markers to make system that will project information to be displayed to the surface like wall. The main application of this design is in educational institution or in any corporate presentation to make the work easy, simple and independent of lots of hardware requirements. Here camera will sense the colour of colour marker and will feed the result to the laptop, laptop will decide the action to do base on the database and projector will project the desired application. The aim of camera and projector based configurations is that the user interaction should be performed with the projected image instead of applying computer interfaces indirectly. A projector-camera pair is used to display the user interface on the projected surface where the camera acquires (camera image) the projected information (projected image) and the gestures of the user provide feedback about the interaction. Usually standard white-boards or screens are used to display the information to the audience.

Here one more important feature is added for searching any word in presentation directly in Google, using colour marker without going to any browser.

Mouse is the most popular input device now-a-days used for the human interaction with the computer systems to interact with the digital world through user's hand. The popularity gained its strength from the days when the development of GUI's based operating systems started like Microsoft Windows 95, Windows 98, Macintosh, Windows amiga, Symbian OS, and many more but still it is dependent on the system. The device i.e. mouse changes the relative position of itself, with respect to the base surface on which it is lying, transforms the motion from the form of two-dimensional coordinates to the device controller to begin the cursor movement on the screen. The mouse clicks, that generates the signals on pressing the mouse buttons acts as an input to the pre-programmed structures that finally fires an event or triggers an activity accordingly. Earlier it was done by using electronic chips but this project emphasize color recognition instead of electronic chips.

This method uses hardware as camera, projector and laptop which together acts as a system. Here aim is to move mouse cursor as the user moves his/her fingers with color markers. For this purpose, three components are used i.e. Camera, Coloured marker and MATLAB installed in Laptop. The approach works in a continuous manner where camera takes the live video, sending to the laptop, and MATLAB installed in laptop processes the input and recognizes the colours at the fingertips of the user. Figure 4 shows the algorithm used in this approach to move mouse cursor on screen.

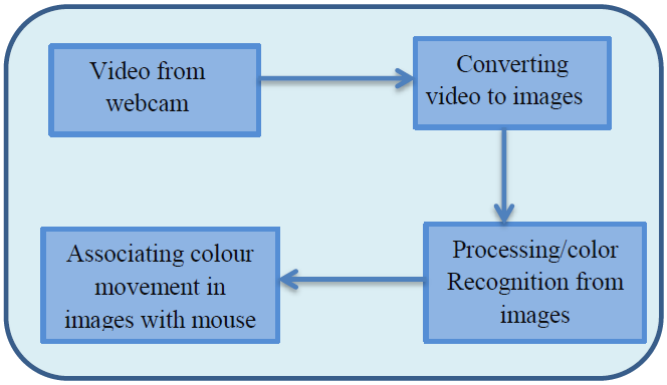

Fig.4. Algorithm for virtual mouse

First interaction with the physical world is done by camera. Camera takes the video and starts recording the live video and in continuation of recording it sends the live video to MATLAB which is already installed in laptop which is connected with the camera. In MATLAB, code is prepared which convert the incoming live video from camera into frames of images or slicing of video is done in the form of images. These images that are obtained from the slicing of video are then processed for colour recognition process. The output of the colour recognition process is the images that contains only those colours of which colour markers are present at the hand of the user. Neither the fingers of user are shown in the output images nor are any background colours in the output images from the colour recognition process. For this purpose, RGB values of the colour markers are set prior in the code so that no other colour will be detected in the image after colour recognition except the desired colour.

The output images are displayed in continuation and at the same speed as the speed at which slicing of video is done, so that it looks like a continuous movie in which the input is physical world and the output is only those colours which are present at the fingertips of the user. The colour is then associated with the mouse cursor in code so that whenever the colour moves in the output image from one position to another, the mouse cursor gets attached at the same position where the colour is now displayed.

V. BLOCK DIAGRAM DETAILS

Hardware block consist of a camera, projector, laptop installed with MATLAB, colour marker. Figure 5 shows the block diagram and working flow of the project.

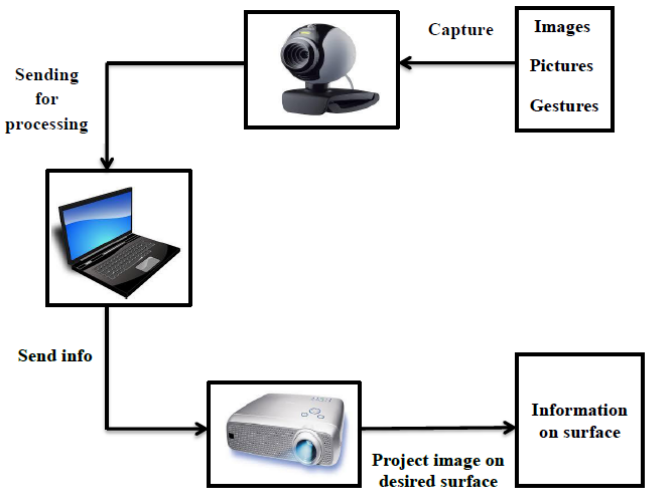

Fig.5. Working Flow

A. *Camera:*

A webcam captures and recognises an object in view and tracks the colour of user's hand gloves using computer-vision based technique. It sends the data to the laptop. The camera, in a sense, acts as a digital eye, seeing what the user sees. It also tracks the movements of the thumbs having red colour marker on front and blue on back, palm of the user's hand is having green colour on it. The camera recognizes objects around you instantly, with the projector overlaying the information on screen.

B. *Projector:*

A projector opens up interaction and sharing. The projector projects visual information on surfaces like walls We want this thing to merge with the physical world in a real physical sense.

C. *Laptop:*

The laptop transmits and receives the data. Laptop should be installed with Matlab 7 version or any higher version. A Web-enabled laptop processes the data and search the required word in google without opening any browser .Narrator application of Microsoft help to listen the name of the icon and the files selected .

D. *Colour Markers:*

It is wrapped around the user's fingers, marking the user's fingers with red, blue & green tape helps the webcam to recognize the desired action to take. The movements and arrangements of these makers are interpreted that act as interaction instructions for the projected application interfaces. Here red colour is associated with mouse movement, blue colour is for searching any word in Google and green colour is for click event of a mouse.

VI.IMPLEMENTATION DETAILS

In this project camera as sensor is used. Camera is attached to laptop by USB. Resolution of camera is 640*480 with 16M colour depth. PC or laptop with Matlab 7 or any higher version installed.

Matlab contains software routines of camera initialization, rgb2hsv conversion, morphological operations, and centroid locating, virtual mouse driver and projector interface. Image obtained by camera goes under series of operations mentioned in algorithm below it, virtual mouse driver will enable cursor getting controlled by Matlab. This is how we are making a close loop system with camera as sensor and moving cursor as actuation. This system can be applied anywhere in applications like easy human machine interaction, internet browsing etc.

VII. ALGORITHM

This model is a novel method for detecting click event. Basically it uses different colour markers one of which will be useful in tracking mouse and another will be useful in detecting click event.

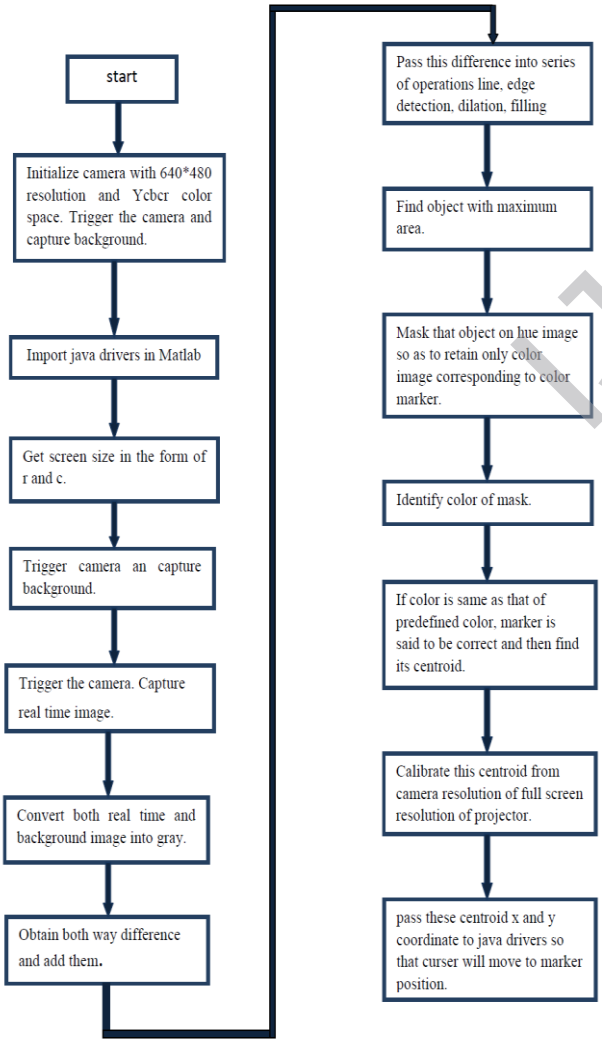

Fig.6 Algorithm for the mouse movement

VIII.RESULT OF PROJECT IMPLIMENTATION

As this project mainly focus on having control of mouse through colour marker, here in fig.7 it can be seen that a text is selected as camera is capturing blue colour, in Matlab window it is showing searching word status. In fig 8 the selected text is being searched in Google.

In fig.8 again new word from opened page is selected and cursor is moved as camera will have red marker in front of it. Fig.9 is showing click event of a mouse to perform minimize window function as camera is having green colour in front of it.

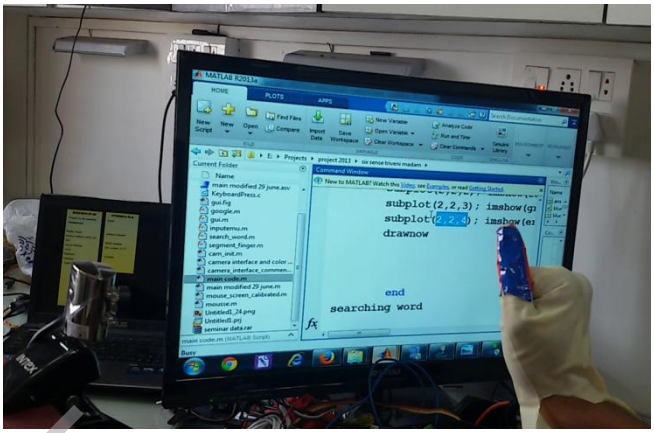

Fig.7

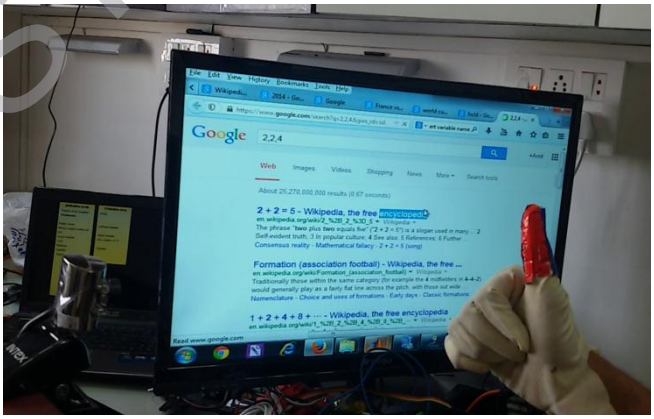

Fig.8

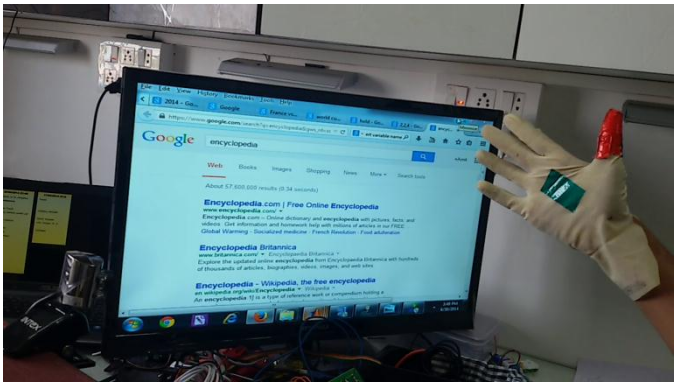

Fig. 9

CONCLUSION

The key of this project is to make Human machine interface simple and easily interactive .Virtual interaction between laptop and user without using hardware like mouse keyboard makes this entire system user friendlier and simpler. Adding sound response to the system makes this system helpful to the visually impaired persons. Clearly, it has the potential of becoming the ultimate "transparent" user interface for accessing information. Having access to internet easily, effectively adds weight to this entire system.

REFERENCES

1. Xingfeng Wang, Kaihuai Qin , "A Six-degree-of-freedom Virtual Mouse based on Hand Gestures", 2010 International Conference on Electrical and Control Engineering, pp. 257-260.
2. Utpal V. Solanki, Nilesh H. Desai, "Hand gesture based remote control for home appliances : Handmote", 2011 World Congress on Information and Communication Technologies IEEE, pp 425-429.
3. Y. Wu and T.S. Huang, "Hand modeling, analysis and recognition for vision-based human computer interaction," IEEE Signal Processing Magazine, vol. 18, May 2001, pp:51-60.
4. Yun Fu and Thomas S. Huang, "hMouse: Head Tracking Driven Virtual Computer Mouse", IEEE Workshop on Applications of Computer Vision (WACV'07), 2007.
5. Vidyasag Potdar, Dr. cesar Ortega-sanchez, "User friendly smart home infrastructure", IEEE conference, IEEE DEST 2011.
6. Gaurav Pradhan, Balakirshnan Prabhakaran, "Hand gesture computing", IEEE Conference , 2011.
7. H. Li and M. Greesspan. "Multi-scale gesture recognition from time-varying contours", Proc. IEEE International Conference on Computer Vision, 2005.
8. D. J. Sturman and D.Zeltzer, "A Survey of Glove-Based Input", IEEE Computer Graphics and Applications, 14: 30-39, 1994.
9. C. Neti, G. Potamianos, J. Luettin, I. Matthews, H. Glotin, D. Vergyri, J. Sison, A. Mashari, and J. Zhou.Audio- "Visual Speech Recognition", Workshop 2000 Final Report, 2000.