ISSN No. 0976-5697

Volume 6, No. 1, Jan-Feb 2015

International Journal of Advanced Research in Computer Science

RESEARCH PAPER

Available Online at www.ijarcs.info

Vision Based Head Movement Tracking for Mouse control

[1]Devanand G. Khandar,[2]Prof. R. V. Manteand [3]Prof. Dr. P.N. Chatur
[1]M.Tech scholar, [2]Asst. Professor, [3]H.O.D
Govt. college of engineering Amravati, MS, India

Abstract: In this Paper, Mouse movement is done by vision based head tracking. The center of head detection is mapped to the mouse coordinates in computer screen. Left click and right click are controlled by voice left and right click command, respectively. Computer Vision has increased the size of research aiming to provide robust and effective techniques of real-time head movement detection and tracking. It provides alternative solutions for convenient device control, which confidences the application of interactive computer games, machine learning and guidance, robotic arm control, and machine access for disabled people who are physically challenged to do day to day life activity. For head movement detection, several different approaches have been proposed and used to implement different algorithms for these technologies.Main objective is to overcome the limitations of the existing system by providing efficient touch less environment to the user, access computer's content via user's speech and different types of cursors, provide interactive visual sensing gaming.

Keywords Head Movement, Mouse Movement, Human Computer Interaction, Computer Vision.

I. INTRODUCTION

A Human life getting improves by the use of a recent new application in the field of Human-Computer Interaction (HCI)and Computer Vision (CV). To deal with the versatile use cases is requiring the future desired Perceptual User Interfaces (PUI) and user interface devices for more reliable and fast system performance. Nowadays much attention has been focused on the scenario of tracking user's movements with a video camera and translating the motion parameters into semantic indicatory symbols to manipulate machine operation. Head and its movements are important in expressing a person's desires, needs and emotional state. Head movement is also found to be a natural, simple and effective way of pointing to objects, interaction and communication. Thus, head movement detection has received significant attention in recent research. One of the various purposes for head movement detection and tracking is to allow the user to interact with a computer[1]. It also provides the ability to control many devices by mapping the position of the head into control signals.

Head movements are the least affected by disabilities because, for example, spinal cord injuries do not affect the ability to control them, as they are directly controlled by the brain[1]and movement is natural. Combining voice commanding and head movement detection can provide a larger number for possible control commands to be used with assistive technologies such as a wheelchair.

Interaction with a computer is one of the various purposes allowed to the user for head movement detection and tracking. Vision based perceptual user system provides an alternative solution for convenient device control. It also significantly helps the disabled and elder people use limited voluntary actions to communicate with others [2].

A hand-free PUI that tracks human body movement in video to manipulate virtual computer pointing devices to respond user intentions is represented by a Camera Mouse system. Over the last decade, active researches have proposed to navigate cursor and trigger mouse click with the movement of eyes, nose, and face [2]. These systems require reliable and fast face tracking strategy, which allows users the comfortable and sufficient motion control. Head tracking can neither automatically initialize itself, nor handle large scaling case. Cursor navigation [3] is handled by face localization. We calculate the relative position of tracking window in the image space and translate it to the cursor position in the screen space. After mouse cursor is navigated to the desired location, mouse button clicks are triggered by voice recognition of particular commands like right, left, double, drag, drop for right click, left click, double click, drag and drop a file respectively.

Experimentally Head position is Captured by a Camera mounted on top of the monitor, a continuous video is framed into images where image consist of user's head on changing direction and translated it to the cursor position in the screen space. The main contributions and advantages of our work are summarized as follows. 1) We proposed a new Camera Mouse [2] system where a hands-free system is proposed which is co-ordinate with the user's interaction. 2) A low cost head pose and motion estimation scheme is introduced with combine approach of voice recognition. 3) We designed an efficient strategy for virtual mouse manipulation in real-time.Haar-like feature is one of popular real-time algorithms that can detect objects correctly[4][8]. The Haar-like feature is the statistical math model of trained kernel. Then we classify kernel with the database[4][8].

The system consists of a robust real-time vision based head tracker, a head position and motion estimator, and a virtual mouse control module. Cursor position is navigated and fine tuned by calculating the relative position of tracking window in image space and the user's head by use of vision based algorithm.

II.SYSTEM DEFINATION AND FRAEWORK

Implemented on typical PC, our camera operated mouse provides a specific virtual human interface for hand-free mouse control. Fig.1 illustrates the system framework of Camera Mouse.

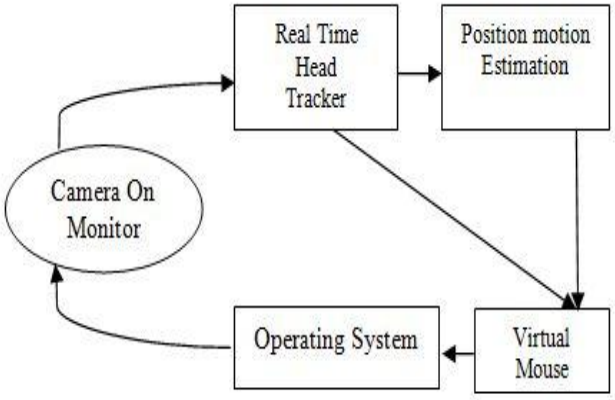

Figure.1 System definition of vision based mouse

By using a common web camera without any calibrated lens, or sensor the system processes each frame of the captured video in real time. The above figure is given by Yun Fu in "hMouse:Head Tracking Driven Virtual Computer Mouse". User's face/head is first automatically [5]detected and tracked by a robust and reliable head tracker. The head pose and motion measurable characteristicsare further estimated by analyzing visual sight. With basic synchronization control visual tracking module navigates cursor and control virtual mouse buttons using the received voice commands. Operating system finally responses all mouse events generated by this PUI[5].

III. ROBUST REALTIME HEAD TRACKER

In each tracking cycle, for a captured video frame, camera operated mouse first processes automatic real time Head detection.

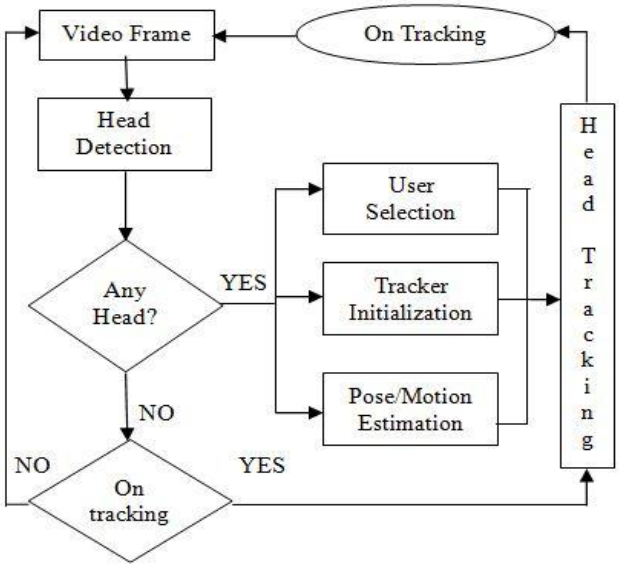

Figure.2 Framework of vision base mouse

The first detection window determined when the cursor by head track is turned on is then selected as the initialization of the real-time tracking module.

The head tracker enables the user to switch between detection and tracking which is complementary exhibiting very reliable performance. There are many existing pure frontal /profile face detection system that shows robustness against occlusion and illumination variation.

If any head is detected three procedures get called i.e. user selection, tracker initialization and head position estimation.

These three procedure are sequential out of which first module is capable detecting user from multiple head depending upon more head exposed area once head is detected tracker is initialized and finally head position estimation is done by vision based algorithms. The detection and tracking are obviously complementary to each other to handle more difficult cases such as user jumping, user come in and out, multiuser occlusion, turning around and large degree rotation.

A. Estimation Of Head Position and Motion:

The solution for window size is called Continuously Adaptive Meanshift (CAMSHIFT) published by Gary Bradsky in his paper "Computer Vision Face Tracking for Use in a Perceptual User Interface"in 1988.Head detection is done by Meanshift [6] andCamshift algorithms to find and track objects in videos. Meanshift algorithm move your window such that center of the new window matches with previous centroid, again find the new centroid. Most of the times, it won't match, So move it again, and continue this iterations such that center of window and its centroid falls on the same location or with a small desired error. Finally you obtain is a window with maximum pixel distribution. This is area of interest where program is needed to focus. Tracker module finds the region of interest in continuous image frames and by finding difference in location of area of interest corresponding cursor is moved to respective location.

Again it applies the Meanshift with new scaled search window and previous window location. The process is continued until required accuracy is met.

B. Motion Tracking By Optical Flow:

The pattern of head movement can be determined by face feature points such as nostril. The movement of feature points and head movement do not vary widely.GentleBoost classifiers are trained to use the coordinates of the nostrils in a video frame to identify the head direction [7].Pattern of head movement is determined by tracking feature points in frame by Lucas-Kanademethod. Optical flow algorithm maps the pattern of apparent motion of image objects between two consecutive frames caused by the movement of object or camera.

Optical flow works on following assumptions:

a. The pixel intensities of an object do not change between consecutive frames.
b. Neighboring pixels have similar motion.

Consider a pixel I(x,y,t) in first frame. It moves by distance (dx,dy) in next frame taken after dt time, since those pixels are the same and intensity does not change, we can say,

$I(x,y,t)=I(x+dx,y+dy,t+dt)$ (1)

Then take Taylor-series approximation of right-hand side, remove common terms and divide by to get the following equation:

$fxu+fyu + ft=0$ (2)

Where: $fx = \frac{\partial f}{\partial x}; fy = \frac{\partial f}{\partial x}; u = \frac{dx}{dt}; v = \frac{dy}{dt}$ (3)

Above equation is called Optical Flow equation. In it, we can find f_x and f_y, they are image gradients. Similarly f_t is the gradient along time. But (u,v) is unknown and cannot solve this one equation with two unknown variables hence solution is Lucas-Kanade method.

All the neighboring consecutive pixels will have similar motion. It takes a 3x3 patch around the point and can find (f_x, f_y, f_t) for these 9 points. A better solution is obtained with least square fit method. Thus in order to identify head movements accurately, the face is first detected, then the nostrils are located and the Lucas-Kanade algorithm is used to track the optical flow of the nostrils. Therefore, we use inter-frame difference in the coordinate of feature points to reflect the head movement. This approach is applicable in head motion recognition systems and it is considered to be fast.

C. *Scaling:*

Based on the estimated object size in*(length, width)* by Camshift we rescale the window size as*((length + width) /2)*.The square window is easily determined as long as the centroid coordinates of the object are calculated.

D. Horizontal And Vertical Motion:

The horizontal and vertical motion are calculated differently. In detection mode, the reference motion point is $R_m = ((W_{left} + W_{right})/2, (W_{top}+W_{bottom})/2)$.

IV. MOUSE CONTROL

A. Move Cursor In Large Scope:

Mouse cursor moves according to the relative co-ordinate centroid motion. Relative cursor motion is multiple of factor of size of the tracking window. Normally it is two time the tracking window speed.

B. Left And Right Button Click:

The event of clicking left and right are handled by voice recognition commands. Voice recognition provides you interactive mode with computer. User has to say some commands such as Left, Right, Double, Drag and Drop. Only these five commands are allowed to handle clicking. The functionalities of these commands are for clicking left, right, open particular file, dragging some file and dropping according to the above sequence.

There are number of voice recognition system that are available on market, the industry leader are IBM and Dragon system.Voice recognition can refer to one of two types of computer science: forensic voice identification or speech-to-text capability. The two basic types of SAPI engines are text-to-speech (TTS) systems and speech recognizers. TTS systems synthesize text strings and files into spoken audio using synthetic voices. Speech recognizers convert human spoken audio into readable text strings and files.

The program matches the audio signature of speech with corresponding entries in the database. The SAPI application programming interface (API) dramatically reduces the code overhead required for an application to use speech recognition and text-to-speech, this makes speech technology more accessible and robust for a wide range of applications. The SAPI API provides a high-level interface between an application and speech engines.

V. CONCLUSION

We have presented the novel head tracking driven Camera Mouse system which significant cherished aspect to remove or to diminish manual controllers such as joysticks or keyboards.

This new generation of technology eases the interaction between human and computer eliminating the intermediate devices, and gives more chance to people with disabilities, to be able to utilize different aspects of technology such as entertainment, during their life. The current version of Mouse is limited by its cursor control mode.

VI. REFERENCES

[1]. Amer al-rahayfeh and miadfaezipour “Eye Tracking and Head Movement Detection: A State-of-Art Survey” IEEE trans. on Rehabilitation Devices and System,2013.

[2]. M. Betke, J. Gips, and P. Fleming, “The Camera Mouse: VisualTracking of Body Features to Provide Computer Accessfor People with Severe Disabilities,” IEEE Trans. on NSRE,Vol. 10, No. 1, pp: 1-10, 2002.

[3]. T. Morris, and V. Chauhan, “Facial Feature Tracking for CursorControl,” Journal of Network and Computer Applications,Vol.29, No.1, 2006, pp. 62-80.

[4]. V. Srisuwarat and S. Pumrin, "A Vision Module Algorithm for Human Face Detection," in The Proceedings of the 31th Electrical Engineering Conference (EECON31), 2008, pp. 1165-1168.

[5]. Yun Fu and Thomas S. Huang “hMouse: Head Tracking Driven Virtual Computer Mouse” IEEE Workshop on computer vision, 2005.

[6]. H.Lue, R.Zhang“ Head Detection and Tracking by Mean-shift and Kalman Filter” Innovative computing,Information ICICIC, 2008.

[7]. L. Jian-Zheng and Z. Zheng, ``Head Movement Recognition based on LK algorithm and Gentleboost," in Proc. IEEE 7th Int. Conf. Netw. Comput. Adv. Inf. Manag., Jun. 2011, pp. 232-236.

[8]. C.Kraichan, S. Pumreen “Face and Eye tracking for controlling Computer function” IEEE conf. on Ele. Electronics, Information, 2014.