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A Mouse Simulation System using Convex Hull Algorithm

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ABSTRACT

Even today, many people still trying to find the ways to interact with computers and hardware to be an unpleasant experience, despite the development of input devices over decades. Nowadays computer vision has reached its pinnacle, where a computer can identify its owner using a simple program of image processing. Computers and hardware should be tailored to our natural modes of communication: Body language and speech. Intelligent machines that can work alongside computers are now being developed, allowing for friendlier Human-Computer Interaction (HCI). Our proposed project, on the other hand, intends a hand gesture-based system that allows users to control desktop mouse movements. To detect hand gesture movements, our system makes use of a desktop webcam. The goal is to control mouse cursor functions with a simple camera rather than a traditional or standard mouse device. Using only a camera, this project provides an infrastructure between the user and the machine. It enables the user to interact with a machine without the need for any mechanical or physical devices, and even allows to make to control mouse functions.

KEYWORDS: Human-Computer Interaction (HCI), Machine leaning, Computer Vision, Image Processing.

1. INTRODUCTION

The project "A Mouse Simulation System using Convex Hull Algorithm" is developed aiming to better the process of human-computer interaction. It aims to provide the user a better understanding of the system and to let them use alternate ways of interacting with the computer for a task. The task here is to control the mouse even from a distance just by using hand gestures. It uses a program in python and various libraries such as PyAutoGUI, Numpy and image processing module OpenCV to read a video feed which identifies the users' fingers represented by three different colors and track their movements. It retrieves necessary data and implements it to the mouse interface of the computer according to predefined notions. The project can be useful for various professional and non-professional presentations. It can also be used at home by users for recreational purposes like while watching movies or playing games. The main objective is to find the solution for the finger tracking in the real world and the control of cursor of a computer is still performed physically. There may be some difficulty in most of the applications to control the mouse physically. We can make use of web cam and with the help of some algorithms, we can control the cursor operations without touching the mouse physically. This work presents the implementation and analysis of real time tracking of fingers which involves in making a gesture so that gestures can be used in various applications of mouse like movement, single click, double click, right click, scrolling. We use some color tip on fingers background subtraction and improving this for bare finger gesture

tracking without any use of colored tips. This involves processing of a running video using image processing algorithms and then track the fingers. The project's primary aim is to improve the scope of human and computerinteraction by developing an effective alternative way of controlling the mouse pointer and its various functions such as left click, right click, scroll up, scroll down and selection. It helps user interact with the computer from a considerable distance without any issue and efficiently without touching the mouse. It also decreases the hardware requirement for the interaction by eliminating the necessity of a mouse. All the user needs are a web camera (which is mostly present in all laptops these days) which can record real-time videos.

STRUCTURE OF PAPER

The paper is organized as follows: In Section 1, the introduction of the paper is provided along with the structure, important terms, objectives and overall description. In Section 2 we discuss related work. In Section 3 we have the complete information about convex Hull Algorithm. Section 4 shares information about the methodology, its advantages, and disadvantages. Section 5tells us about theresults and its description. Section 6 tells us about the future scope and conclusion the paper with acknowledgement and references.

OBJECTIVES

This project will help to address the problems related to the human and computer interaction. This project is used to interact efficiently with the computer without any requirement of the hardware devices like mouse and wires etc.

2. RELATED WORK

There are numerous works that have been done related to image processing.

Vantukala VishnuTeja Reddy [1] has investigatedvirtual mouse implemented with fingertip recognition and hand gesture tracking based on image in a live video is one of the studies.

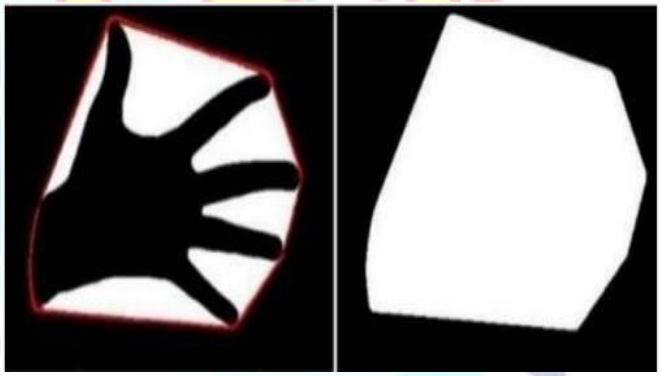
Sugnik Roy Chowdhury [2] has investigated regarding the virtual mouse and keyboard with no wire or external devices.

LI Wensheng Deng Chunjianhas researched on the Virtual Mouse in mission vision present an efficient algorithm based on color to track the movement of fingertips in real time, then we present a set of messages (including elementary fingertip message and simulated mouse message) that are generated according to the result of fingertip tracking.

These authors helped a lot to the viability of image processing to achieve the simulation of virtual mouse.

3. CONVEX HULL ALGORITHM

This algorithm is used for the defect calculation. The convex Hull is a process which is required for any computer application relating with human skin color or as can be said as interaction with human hand. It calculates the contour or say it does the contour analysis for detecting the fingertips. It grasps the location of our fingertip based on the various geometric features of contour which are present, such as fingertip edge detection. Method. This project is based on fingertip detection based on convex hull approach [5].

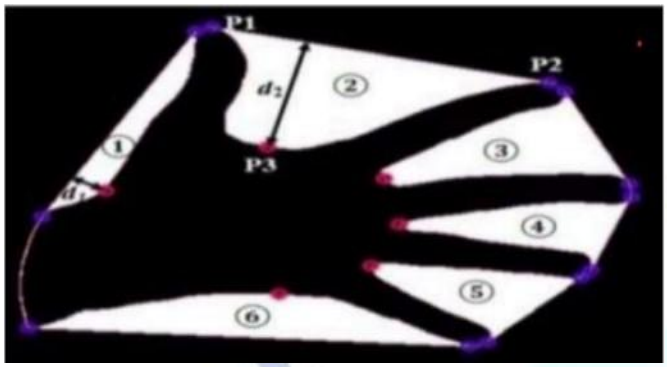


The above figure describes that convex hull contour is the convex polygon surrounded by all the convex vertices in gesture contour, as shown in figure, the polygon composed by red curve is the convex hull of gesture, and is the separated convex hull extracted from figure. Convex Defect Difference in between gesture convex hull and contour defined to be as convex defect. As shown in the figure, thewhite areas from 1 to 6 are all the defects. This Convex defect contains three main components first one is start contour point, second one is end contour point and the last one is concave contour point [4].

Formula For Convex Hull Defect :

$$\delta = \frac{contourArea}{hullArea}$$

Here The tightness of the convex hull can be depicted using the symbol (δ). Hull Area is the area of the hull and contour Area is the area of the contour and can get the value of δ and determine the gesture [9].



In the above figure describes an example to understand it better as you can see the figure for convex defect 2, P1 which is thumb is its start contour point from where the defect started, P2 is its end contour point which is the point of termination of the defect or can say the defect terminated, and as you can see the point P3 is the concave point which is the furthest point away from the convex hull, and the depth of convex defect is find by that furthest point distance[3]. During any sudden movement of the hand or object in front of the camera the program will not consider it as a detectable object as a 1 second delay is given in terms of the program to decide that if it is a detectable object or not. So sudden movement won't be considered as an input [7]. In terms of printing an alphabet twice use gesture for once then give a second delay and then show the similar gesture again, this will not confuse the program that it's a similar input and would prohibit the program in taking it as a garbage value [8].

4. METHODOLGY

The Mouse uses a convex hull process for its working, defects are captured or read, using this detects the functions of the mouse are mapped. The process of this image recognition process solely focuses on defects and conditional statements, the convex hull takes the gap of the fingers as defects, so it can be used for multiple gestures and mapping commands [2]. The following steps are followed for the use for gesture recognition and its mouse functions. In the first step, the web cam will start and the video and what is present in front of the camera can be seen. In the next step the user has to keep their hand in the required border made on the screen. In this step the different hand gestures will be shown by the user, these gestures will be not any kind of a gesture but those which have been trained to the computer from the beginning. If the gesture matches, then a green colored border will be generated and by moving the hand the mouse cursor will also move. There is total four different kind of gesture, one is used to move the cursor, another one is used to do the right click, another one is used for left click, and another gesture for scrolling up and down. When no hand is placed in the bordered region a comment will show that there is no object placed. The similar gestures may not match sometime this is due to the reason that the user is not showing the gesture accurately or there are a few noises which are affecting the inputs. The gestures count the defect using Convex Hull method and relates with the object used for mapping. The proposed system is a computer vision application that is based on real time application system. It makes the use of OpenCV for image processing and image acquisition and PyAutoGUI for handling mouse control with the help of hand gesture recognition [1]. The basic block diagram of computer vision pipeline is shown in figure.

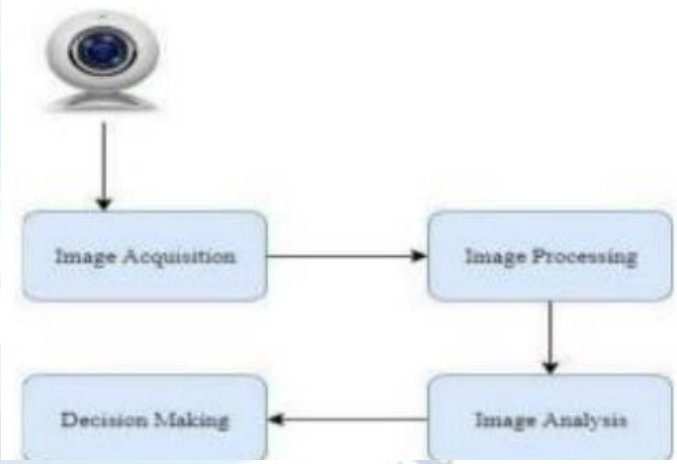


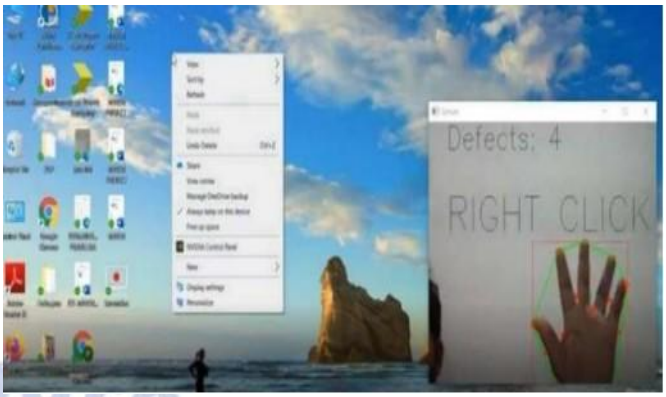
Image Acquisition Image or the frame that is detected by the webcam is acquired as the digital representation of the visual characteristics of the physical world. An image sensor or the web-cam is used to detect and capture the information required to make an image. Image Processing Image acquired are then processed in the next step. The signals in the acquired images are filtered to remove the noise or any irreverent frequencies. If needed, images are padded and transformed into a different space, so to make them ready for the actual analysis. Image Analysis The processed image is analyzed to extract useful information. This step involves many important image properties like pattern identification,

color recognition, object recognition, feature extraction, motion tracking, and image segmentation. Decision Making High dimensional data obtained from all the above steps are used to produce meaningful numerical information, which leads to making decision.

5. RESULTS

In order to achieve accuracy, and consistency of the Mouse Simulation System, testing phase have been conducted on various scenarios. Performance depends on various factors Brightness, Color Conflicts, Tilt and Rotation, Distance. The purpose of testing phase is to ensure that the final deliverable is able to perform flawlessly in terms of accuracy, consistency, and performance. To achieve that, the program has to able to recognize the colors input provided by the users with minimal adjustment, provide that the colors are thoroughly calibrated at first hand. Furthermore, the program is required to be able to execute the mouse functions efficiently and accurately as well. A method for on-screen cursor control without any physical connection to a sensor is presented. Different hand gestures is used for this purpose. Different operations of mouse controlled are single left click, double left click, right click and scrolling. Range of skin color can be varied in the program in accordance with the person to be used, surroundinglightening conditions. An approximate area ratio that is not being used by the hand in the convex hull is taken after analyzing the program output at different gestures of the hand. This work can be used in various real time applications like cursor control in a computer, android based smart televisions etc. Although there are devices like mouse and laser remotes for the same purpose, this work is so simple so that it reduces the usage of external hardware in such a way[6].

Left click operation is performed by hand gestures The above figure shows that the left click operation is performed by using the hand gesture where the number of defects is two.



Right click operation is performed by hand gestures. The above figure shows that the right click operation is performed by using the hand gesture where the number of defects is four.

6. FUTURE SCOPE AND CONCLUSION

The system works well for the simple pointing and pinching gestures, there is still many improvements is needed. Currently the system uses a static background, but it would be very desirable and important to use this hand tracking system in a world of augmented reality setting it in a way where a user, wearing a head-mount display, could interact with virtual 3D objects in the real-world. For this scenario, more than one layer of capturing ability is needed, which needs multidimensional camera angle capturing the hand gestures. It requires the cameras on 3-axis, X axis, Y axis, Z axis. On the basis of the camera recordings the 3-D image will be captured or recorded, and the defects count will get more accurate, and it will be easier for the computer to read the image and defecate the defects.

Overview In conclusion, it's no surprised that the physical mouse will be replaced by a virtual non-physical mouse in the Human-Computer Interactions (HCI), where every mouse movement can be executed with a swift of your fingers everywhere and anytime without any environmental restrictions. This project had developed a color recognition program with the purpose of replacing the generic physical mouse without sacrificing the accuracy and efficiency, it is able to recognize gestures and its combinations, and translate them into actual mouse functions. Due to accuracy and efficiency plays an important role in making the program as useful as an actual physical mouse, a few techniques had to be implemented. The purpose of this implementation is to promote convenience in controlling the program without much of a hassle. Therefore, actual mouse functions can be triggered accurately with

minimum trial and errors. Furthermore, to promote efficient and flexible tracking of colors, calibrations phase was implemented. Other than that, adaptive calibrations were also implemented as well, it is basically allows the program to save different set of HSV values from different angles where it will be used during the recognition phase. In Overall, the modern technologies have come a long way in making the society life better in terms of productivity and lifestyle, not the other way around. Therefore, societies must not mingle on the past technologies while reluctant on IA(HONS) Information System Engineering Faculty of Information and Communication Technology (Perak Campus), UTAR 40 accepting changes of the newer one. Instead, it's advisable that they should embrace changes to have a more efficient, and productive lifestyle.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Vantukala VishnuTeja Reddy, Thumma Dhyanchand, Galla Vamsi Krishna, Satish Maheshwaram: Virtual Mouse Control Using Colored Fingertips and Hand Gesture Recognition 2020 IEEE-HYDCON.

[2] Siddhika Aher, Bhairavi Brahme, Chhaya Upadhyay, Megha Gupta, Debajyoti Mukhopadhyay; An Experimentation to Simulate Mouse Movement using Hand Gestures based on Human Computer Interaction; International Journal of Computer Applications June 2019.

[3] Chetana S. Ingulkar, A.N. Gaikwad; Hand Data Glove: A wearable real-time device for human computer Interaction; J. International Journal of Science and Engineering, ISSN-2347- 2200, Volume 1, Number 2; 2013.

[4] Zhi-hua Chen, Jung-Tae Kim, Jianning Liang, Jing Zhang, and Yu-Bo Yuan; Research Article Real-Time Hand Gesture Recognition Using Finger Segmentation; Department of Computer Science and Engineering, East China University of Science and Technology, Shanghai 200237, China;25 June 2014.

[5] Chu-Feng Lien; "Portable Vision-Based HCI – A Real-time Hand Mouse System on Handheld Devices"; National Taiwan University, Computer Science and Information Engineering Department.

[6] Kamran Niyazi, Vikram Kumar, Swapnil Mahe, and Swapnil Vyawahare; Mouse Simulation Using Two Coloured Tapes; Department of Computer Engineering, AISSMS COE, University of Pune, India International Journal of Information Sciences and Techniques (IJIST) Vol.2, No.2; March 2012.

[7] A. Erdem, E. Yardimci, Y. Atalay, V. Cetin; Computer vision-based mouse, A. E. Acoustics, Speech, and Signal Processing; Proceedings (ICASS) IEEE International Conference 2002.

[8] N. Subhash Chandra, T. Venu, P. Srikanth, "A Real-Time Static & Dynamic Hand Gesture Recognition System", International Journal of Engineering Inventions, Volume 4, Issue 12, August 2015.