Literature Review

Mouse Cursor Control System Based on Hand Gesture  
<https://www.sciencedirect.com/science/article/pii/S2212017316001389>

Authors: Horatiu-Stefan Grif, Cornel Cristian Farcas

Abstract: The paper presents a HCI interface for mouse cursor control. The purpose of the implemented solution is to control the mouse cursor by user hand gestures captured through a webcam. For improving the gesture recognition based on the fluctuation of illuminance levels the finger strips color detection was used. The results reveal the good behavior of the system in low light condition.

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| Pros | Cons |
| Works well in low lighting.  It gives better precision than other similar applications. | Use of external webcam.  Requires a stable background.  The gesture recognition task is influenced by the rotation of the hand on the plane of the pad. |

Controlling Mouse Pointer Using Web Cam  
<https://www.irjet.net/archives/V3/i10/IRJET-V3I10233.pdf>

Authors: Gaurav Sahu, Sonam Mittal

Abstract: This paper deals with the management and enhancement of human interaction with the digital world. Advancement in technology and advanced computing devices allow us to be in continuous touch with the digital world and at the same time restriction of information on traditional platforms like paper, digital screen etc. is overcome with this technology.

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| Pros | Cons |
| All basic mouse functions can easily be carried out.  It can be applied to areas of Augmented Reality, Computer Gaming etc. | Use of colour strips instead of actual finger detection.  Calculations used are complex which makes the system difficult to understand and extend forward. |

Finger Gesture Control Computer Mouse With Image Processing  
<https://pdfs.semanticscholar.org/4999/50dd0062ef2320fc84a46b10c5b04e8e2083.pdf>

Author: Heera Lal Bhadrecha

Abstract: Controlling the mouse cursor movement and clicks events (Left & Right click) of the computer mouse using finger motion and gestures. Finger gestures were acquired using a camera based on skin detection algorithm with different angle detected images. This method mainly focuses on the use of Web-Camera to create a cost-effective virtual mouse using webcam with image processing

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| Pros | Cons |
| Cost Effective  Vast range of applications. | Limited functionality.  Output is fluctuated due to change in lighting.  Pc requires high computations capacity to run the complex functions. |

Human hand gesture based system for mouse cursor control  
<https://www.sciencedirect.com/science/article/pii/S2351978918304438>

Authors: Horatiu-Stefan Grif, Trian Turc

Abstract: The goal of the paper is to improve the recognition of the human hand postures in a Human Computer Interaction application, the reducing of the time computing and to improve the user comfort regarding the used human hand postures. The authors developed an application for computer mouse control. The application based on the proposed algorithm, hand pad color and on the selected hand feature presents good behavior regarding the time computing. The user has an increased comfort in use of the system due to the proposed hand postures. Also, the system works well having the same behavior under very low illuminance level and high illuminance level.

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| Pros | Cons |
| Uses natural and more relaxed postures.  No additional noise removal filter is used. | Works well only in well-lit environments.  A single colour background is required to detect the gestures. |

Advanced mouse pointer control using trajectory-based gesture recognition  
<https://ieeexplore.ieee.org/document/5453841>

Authors: [Kabeer Manchanda](https://ieeexplore.ieee.org/author/37403020600), [Benny Bing](https://ieeexplore.ieee.org/author/37275316400)

Abstract: In this paper, a method to control the movement of a mouse pointer using simple hand gestures and a webcam is proposed. A real-time tracking algorithm is implemented based on adaptive skin detection and motion analysis. Using the history of motion, the trajectory of the movement of the hand is drawn and then used to identify a gesture. A region of interest algorithm is proposed, in order to scale the motion when the user is located far away from the point of capture. The motion of the mouse pointer is scaled accordingly. Demonstrations using our prototype clearly illustrate the benefits of our system.

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| Pros | Cons |
| Project can be easily scaled.  Trajectory based hand gesture recognition helps to better understand the desired | It would be difficult to control the mouse from a long distance.  Lighting conditions affect the generated output. |

Design and Development of Hand Gesture Based Virtual Mouse  
<https://www.researchgate.net/publication/336304431_Design_and_Development_of_Hand_Gesture_Based_Virtual_Mouse>

Authors: Kabid Hassan Shibly, Samrat Kumar Dey, Md. Aminul Islam, Shahriar Iftekhar Showrav

Abstract: This paper proposes a virtual mouse system based on HCI using computer vision and hand gestures. Gestures captured with a built-in camera or webcam and processed with color segmentation & detection technique. The user will be allowed to control some of the computer cursor functions with their hands which bear colored caps on fingertips. Primarily, a user can perform left clicks, right clicks, and double clicks, scrolling up or down using their hand in different gestures. This system captures frames using a webcam or built-in cam and processes the frames to make them track-able and after that recognizes different gestures made by users and perform the mouse function. So the proposed mouse system eliminates device dependency in order to use a mouse.

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| Pros | Cons |
| Most mouse functions can be carried out.  It can be used for patients with very limited limb control.  It is also usable in sign language. | External camera is required for the software to correctly detect the gestures. The background highly influences the output generated. Colour strips are used to detect different fingers. |

Gesture Recognition Based Mouse Events  
<https://www.researchgate.net/publication/259625051_Gesture_Recognition_Based_Mouse_Events>

Authors: Rachit Puri

Abstract: This paper presents the maneuver of mouse pointer and performs various mouse operations such as left click, right click, double click, drag etc using gestures recognition technique. Recognizing gestures is a complex task which involves many aspects such as motion modeling, motion analysis, pattern recognition and machine learning.

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| Pros | Cons |
| Can be used by physically disabled people. It could be used in various fields like controlling TV channels, using smartphones etc. | Only some functions are currently possible. Some mouse lag in observed in the implementation. |

Cursor Movement by Hand Gesture  
<http://www.ijesrt.com/issues%20pdf%20file/Archive-2017/March-2017/34.pdf>

Authors: Onkar Yadav, Sagar Makwana, Pandhari Yadav, Prof. Leena Raut.

Abstract: The paper proposes hand tracking based a virtual mouse application, which can be implemented using a regular webcam. Our method is to use a camera and computer vision technology, such as image segmentation and gesture recognition, to manage mouse tasks (left and right clicking, double-clicking, and scrolling) and we show how it can perform everything current mouse devices can.

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| Pros | Cons |
| This project will profit the mobile systems where using pointing devices is tough.  It is easy to run and implement by the new user as the user would not be required to run any additional file apart from the executable file. | Digital camera is required to input the video frame.  Only some of the functions can be carried out properly. |

Computer Cursor Control Mechanism by Using Hand Gesture Recognition  
<https://www.ijcsmc.com/docs/papers/March2015/V4I3201582.pdf>

Authors: Kalyani Pendke, Prasanna Khuje, Smita Narnaware, Shweta Thool, Sachin Nimje

Abstract: The project mainly aims at mouse cursor movements and click events based on skin detection technique. It is a cost-effective real time working system. Then it can be used for general purpose or at work places. Even there is a demand of more and more application-based devices, where the latest example can be of smart phones. Traditionally, we use hardware devices i.e. the mouse and keyboard to interact with the system. But due to the growth of technology and demand of virtualization, this technique has been proposed.

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| Pros | Cons |
| It can be used to control presentations in meetings without having to move around much. | Limited functionality is present in the project. Environment lighting affects the system output. |

Virtual Mouse Using Hand Gesture  
<https://www.irjet.net/archives/V5/i4/IRJET-V5I4872.pdf>

Authors: Abhilash S , Lisho Thomas, Naveen Wilson, Chaithanya C

Abstract: - This paper proposes a novel camera vision based cursor control system, using hand gestures captured from a webcam through a color detection technique. The system will allow the user to navigate the computer cursor using their hand bearing color caps or tapes and left click and dragging will be performed using different hand gestures. And also it performs file transfer between two systems in a single same network. The proposed system uses nothing more than a low resolution webcam that acts as a sensor and it is able to track the users hand bearing color caps in two dimensions. The system will be implemented using the python and OpenCV. The hand gesture is the most effortless and natural way of communication. The output of the camera will be displayed on the monitor. Shape and position information about the gesture will be gathered using detection of color. The file transferring scheme is implemented by using the python server programming.

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| Pros | Cons |
| Its main aim is to focus on humans that don’t have control of their limbs | Very limited functionalities.  Lighting affects the results. |

Efficient Fingertip Tracking and Mouse Pointer Control for a Human Mouse  
<https://link.springer.com/chapter/10.1007/3-540-36592-3_9>

Authors: Jiyoung Park , Juneho Yi

Abstract: This paper discusses the design of a working system that visually recognizes hand gestures for the control of a window based user interface. We present a method for tracking the fingertip of the index finger using a single camera. Our method is based on CAMSHIFT algorithm and it tracks well particular hand poses used in the system in complex backgrounds. We describe how the location of the fingertip is mapped to a location on the monitor, and how it is both necessary and possible to smooth the path of the fingertip location using a physical model of a mouse pointer. Our method is able to track in real time, yet does not absorb a major share of computational resources. The performance of our system shows a great promise that we will be able to use this methodology to control computers in near future.

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| Pros | Cons |
| Based on CAMSHIFT.  Easily able to follow the movement of hand. | Research and Development is expensive and consumes a lot of data. |

A Review on Virtual Mouse Using Hand Gesture and Color Detection  
<https://www.ijarse.com/images/fullpdf/1502718284_IFUNA1048IJARSE.pdf>

Authors: Nalini Jungare

Abstract: Now a day‟s intelligent machine which can be used along with the computer are being developed, which helps in friendly Human Computer Interaction (HCI). Mouse & keyboard are unnatural and cumbersome to use at times by disabled people. Virtual mouse or keyboard is the solution for the disabled people to handle the computer system. In the recent years different technologies are used for developing the virtual mouse. In this paper, we have tried to provide a review on different technologies for the virtual mouse.

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| Pros | Cons |
| Various functionalities added. | External Web Camera Used.  Colors used to detect hand and perform functionalities. |

Simulation of Mouse using Image Processing Via Convex Hull Method  
<http://www.ijircce.com/upload/2016/march/78_3_Simulation.pdf>

Authors: Ahemad Siddique , Abhishek Kommera ,Divya Varma

Abstract: Computer and human life is co-related with communication. For better performance it is mandatory that the user interact with the machine to enhance productivity. Based on extrapolation of past trends and examination of technologies under development the following paper serves to be a new approach for controlling mouse movement using image processing technique. Most existing approaches involve changing mouse components or miniaturization of mouse design with advancement in computing. We propose to change the hardware design itself. The following paper is similar to the base research for Human Computer Interaction (HCI) which observe the way in which human interacts with computer and design technologies. The proposed paper makes use of image processing via Convex Hull Method and uses human hand gestures to replace mouse functions.

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| Pros | Cons |
| It uses Convex Hull Algorithm , which makes hand detection easy. | Heavy Software.  Requires latest technology for smooth operation. |

Mouse Control using a Web Camera and Hand Gestures with Colour Tapes  
<http://www.ijste.org/articles/IJSTEV2I11303.pdf>

Authors: Akshay Ishwar Pawar, Sahil Prakash Tumbare , Tejal Avinash Godse , Tejaswini Wagh

Abstract: In this paper, we represent a novel approach for better human computer interaction (HCI) where we are using hand gesture recognition using real-time camera in order to overcome the drawbacks of existing methods and make the system cheaper and more user friendly. Hand gestures are acquired using web camera based on color detection. In this paper two color tapes (dynamic colors) are used on fingers. The tapes will be used for controlling cursor movement and the relative distance between the two colored tapes will be used for click events of the mouse. Through web camera the real time video is captured.

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| Pros | Cons |
| Low Cost.  Moderate Complexity. | Limited Functionalities.  Low Accuracy. |

Enhancing User Experience Using Hand - Gesture Control  
<https://www.ijitee.org/wp-content/uploads/papers/v8i6/F3683048619.pdf>

Authors: Sai Prasanth, Aswathy Gopalakrishnan, Oviya Sivakumar, A. Aruna

Abstract: Verbal interaction is one such venue that was looked into. Speaking to a device makes things seem natural for us, and that is exactly what we are doing in the case of smart assistants. However, interaction through gestures is a very natural, intuitive and original way to interact with a computer. The objective of this system is to make the interaction between a computer and a human seem as natural as the interaction between humans. Our main goal is to highlight a means or a method to make this interaction possible. We recognize live hand gestures using colour signs as a means of differentiation between the gestures. We use ROI (Region of Interest) to map out the cardinality points and functions of interest

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| Pros | Cons |
| Low Cost.  No external Equipment. | Limited Functionalities.  Use of Color tapes and no hand detection. |

A Method for Controlling Mouse Movement using a Realtime Camera  
<https://cs.brown.edu/research/pubs/theses/masters/2010/park.pdf>

Authors: Hojoon Park

Abstract: This paper presents a new approach for controlling mouse movement using a real-time camera. Most existing approaches involve changing mouse parts such as adding more buttons or changing the position of the tracking ball. Instead, we propose to change the hardware design. Our method is to use a camera and computer vision technology, such as image segmentation and gesture recognition, to control mouse tasks (left and right clicking, double-clicking, and scrolling) and we show how it can perform everything current mouse devices can. This paper shows how to build this mouse control system.

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| Pros | Cons |
| Use of color filters to detect hands of different skin colors. | Complex Programming.  Limited Functionalities.  Low Accuracy. |

Gesture Based Interface Using Motion and Image Comparison  
<https://idc-online.com/technical_references/pdfs/information_technology/Gesture%20Based%20Interface.pdf>

Authors: Shany Jophin , Sheethal M.S , Priya Philip , T M Bhruguram

Abstract: This paper gives a new approach for movement of mouse and implementation of its functions using a real time camera. Here we propose to change the hardware design. Most of the existing technologies mainly depend on changing the mouse parts features like changing the position of tracking ball and adding more buttons. We use a camera, colored substance, image comparison technology and motion detection technology to control mouse movement and implement its functions

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| Pros | Cons |
| Use of color tapes to add functionalities | Low Accuracy.  No Functionalities only mouse maneuvering. |

Gesture Based Computing as an Alternative to Mouse by Calibrating Principal Contour Process Actions  
<http://www.ijrat.org/downloads/Vol-2/may-2014/paper%20ID-25201413>

Authors: Chinnu Thomas , D.Lakshmi

Abstract: The topic of user experience and interaction has been increasingly popular and widespread lately. Unlike decades ago, when people place most of their attentions on the quality and functionality, or brand of a product, at the present time, the user interaction experience and usability seems to be the vital element when people are considering and selecting a product. Gesture based computing enables humans to interface with the machine (HMI) and interact naturally without any dedicated devices. Building a richer bridge between machines and humans than primitive text user interface or even (graphical user interfaces) GUIs, which still limit the majority of input to keyboard and mouse. In fact we are bridging this gap by bringing intangible, digital information out into the tangible world, and allowing us to interact with this information via natural hand gestures. Gesture Based Computing provides an attractive alternative for human computer interaction (HCI).

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| Pros | Cons |
| High Accuracy.  Recognition rate – 90.45% | Use of external gloves for hand detection.  Time consuming.  Confusion between gestures. |

Design of Gesture Controlled Wireless Mouse Using Microcontroller  
<https://www.ijareeie.com/upload/2015/july/9_Design.pdf>

Authors: Suneeta V.Budihal , Anant R Choudhari , Kripa S Patil , Nayana P Desai

Abstract: This paper presents an advanced design of a Human Computer Interface (HCI) using wireless and accelerometer technology, for better interaction facility with computer and serves to be of great use to physically challenged people. To ensure wearable computing to be more widely accepted, the associated Human-Computer Interface will have to move past today's keyboard, keypad, touch screen, and any other bulky hand-held interfaces to allow a user to specify their input through their fingers without taking their eyes and attention off their immediate focus and without disturbed attention. As a result, this leads to invention of a wearable system to track hand gestures with the help of an accelerometer.

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| Pros | Cons |
| High Accuracy.  Various Functionalities. | Use of external equipment.  Expensive as microprocessors and microcontrollers are used. |

Hand Gesture Recognition using Webcam<http://article.sapub.org/10.5923.j.ajis.20170703.11.html>

Authors: Athiya Marium, Deepthi Rao, Divina Riya Crasta, Kavya Acharya, Rio D’Souza

Abstract: The communication between the user and the computer can be done through various input devices such as thekeyboard, mouse etc. However, this paper presents a more natural and intuitive form of communication i.e. via hand gestures. The gesture performed by the user is recognised and the action specific to it is performed, thus eliminating the use of any of the hardware input devices completely. This method makes use of image processing to recognise the gestures and has built in functions for every gesture provided by the PyAutoGUI module. It is coded in Python and uses the OpenCV library. Experiments show that the implementation is reliable enough for practical use.

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| Pros | Cons |
| Various Functionalities.  Simple Code. | Low Accuracy.  Lighting affects performance significantly. |

Cursor Movements Controlled By Real Time Hand Gestures  
<https://www.ijsr.net/archive/v2i2/IJSRON2013463.pdf>

Authors: K. Madhuri , L. Praveen Kumar

Abstract: This paper discusses a new approach for cursor movement using real time hand gestures. This explains whether, how to design human-computer interface and to regulate the set of motions of human hand. As we use empty hand for controlling the movement of cursor on pc, this system totally eliminates the usage of sensors and batteries. Here we propose to change the hardware design. Most of the existing technologies mainly depend on changing the mouse parts features like changing the position of tracking ball and adding more buttons. We use a camera, image comparison technology and motion detection technology to control mouse movement and implement its functions.

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| Pros | Cons |
| Simple Code.  No external equipment. | Limited Functionalities, only basic functions.  User’s color of clothes can also affect function.  Lighting affects performance significantly. |

Virtual Mouse Using Hand Gesture Recognition  
<https://www.ijraset.com/fileserve.php?FID=8713>

Authors: Kishore Prabahar

Abstract: Most devices use touch screen technology which cannot be affordable to all the applications. A virtual human computer interactive module such as virtual mouse, can be an alternative way for the traditional touch screen. The objective is to create an hand tracking application to interact with system, and develop a virtual human computer interaction module. This module can be used for creating an interface between computer and human using hand gestures. This module is expected to gain abundance of attention because of its applications for human machine interface and its most futuristic design

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| Pros | Cons |
| No external equipment.  Cheap Process as all software is free. | Tracking must be specifically adapted for each user. |

Computer with Hand Gestures  
<http://www.estirj.com/Volume.3/No.1/9Sana319.pdf>

Authors: Sana Ahmed , Wajiha Shah

Abstract: Gesture is one of the most efficient and vivid way of communication between a human and computer. This study investigates to access the method of human interaction with digital world by performing gestures with hand movement that will control computer mouse pointer with hand gestures in a cost-effective manner that is by using the built-in computer webcam. The basic aim of this work is to develop easier ways for human to interact with computers which is possible by hand gesture recognition. Controlling computer wirelessly by only our hand movements will introduce a new feature for future enhancements.

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| Pros | Cons |
| Cheap Process as all software is free. | Low Accuracy.  Color based recognition. |

Hand Recognition and Gesture Control Using a Laptop Web-camera  
<https://web.stanford.edu/class/cs231a/prev_projects_2016/CS231A_Project_Final.pdf>

Authors: Zi Xian , Justin Yeo

Abstract: Hand gesture recognition is a technology that is becoming increasingly relevant, given the recent growth and popularity of Virtual and Augmented Reality technologies. It is one key aspect to HCI, allowing for two-way interaction in virtual spaces. However, many instances of such interaction are currently limited to specialized uses or more expensive devices such as the Kinect and the Oculus Rift. In this paper we explore the methods for hand gesture recognition using a more common device – the laptop web-camera. Specifically, we explore and test 3 different methods of segmenting the hand, and document the pros and cons of each method. We will also cover one method for hand gesture recognition.

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| Pros | Cons |
| No external equipment.  Use of canny edge detection. | Limited functionalities.  Low Accuracy.  Limited research performed. |