IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 4, April 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204233 |

Gesture Recognition Based Virtual Mouse and Keyboard

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ABSTRACT: With the proliferation of touch-enabled devices and the advancement of gesture recognition technologies, the paradigm of human-computer interaction (HCI) has been evolving rapidly. Gesture recognition-based virtual mouse and keyboard systems have emerged as promising solutions to augment traditional input methods and enhance user experience. This paper presents a comprehensive review of the state-of-the-art in gesture recognition-based virtual mouse and keyboard systems. Gesture recognition based virtual based virtual mouse and keyboard system present a ground breaking fusion of technology and human computer interaction, offering an innovative way to interact with computers and digital devices These system harness the power of machine learning and computer vision to translate hand and body movements into actionable commands effectively replacing the traditional input devices like mouse and keyboard By allowing users to control their computers through intuitive gestures these system open up new possibilities for more natural and immersive ecomputing experiences In this project we will delve into fascinating world of gesture recognition technology and explore how it is revolutionizing the way we interact with our digital devices ,ushering in new era of computer interaction.

KEYWORDS: Gesture recognition, virtual keyboard and mouse, haar cascade algorithm, virtual .

I. INTRODUCTION

In the domain of human computer interaction, the evolution of input deviceshas continuously sought to bridge the gap between users and machines, striving for more intuitive and efficient means of communication. One significant stride in this journey is the advent of gesture recognition technology, offering a paradigm shift from conventional input methods like keyboards and mice.

Gesture recognition-based virtual mouse and keyboard systems represent a pioneering approach that harnesses the power of human gestures to control computing devices. These systems enable users to manipulate virtual interfaces through natural hand movements and gestures, eliminating the need for physical peripherals and opening doors to a more immersive and ergonomic computing experience.

These virtual mouse use libraries such as numpy, tkinter etc and algorithm such as haar cascade algorithm. Haar cascades are machine learning object detection algorithms. They use use Haar features to determine the likelihood of a certain point being part of an object. Boosting algorithms are used to produce a strong prediction out of a combination of “weak” learners.

II. LITERATURE SURVEY

With the rapid development of computer vision, the demand for interaction between human and machine is becoming more and more extensive. Since hand gestures are able to express enriched information, the hand gesture recognition is widely used in robot control, intelligent furniture and other aspects. The paper realizes the segmentation of hand gestures by establishing the skin color model and Ada Boost classifier based on haar cascade according to the particularity of skin color forhand gestures, as well as the de naturation of hand gestures with one frame of video being cut for analysis. In this regard, the human hand is segmented from the complicated background, the real-time hand gesture tracking is also realized by CamShift algorithm. Then, the area of hand gestures which has been detected in real time is recognized by convolutional neural network so as to realize the recognition of 10 common digits.. In human-computer interaction, virtual mouse implemented with finger tip recognition and hand gesture tracking based on image in a live video is one of the studies. In this paper, virtual mouse control using finger tip identification and hand gesture recognition is proposed. This study consists of two methods for tracking the fingers, one is by using colored caps and other is by hand gesture detection. This includes three main steps that are finger detection using color identification,

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hand gesture tracking and implementation on on-screen cursor. In this study, hand gesture tracking is generated through the detection of the contour and formation of a convex hull around it. Features of hands are extracted with the area ratio of contour and hull formed. Detailed tests are performed to check this algorithm in real world scenarios.

Scope of Work

The scope of work for developing a Gesture Recognition-Based Virtual Mouse and Keyboard system involves several key stages and tasks:

Requirement Analysis:

Gather and analyze requirements from stakeholders, including end-users, developers, and project sponsors.

Define the functional and non-functional requirements of the system, considering factors such as accuracy, latency, compatibility, and usability.

Research and Prototyping:

Conduct research on existing gesture recognition technologies, algorithms, and frameworks.

Prototype different approaches for gesture detection, classification, and mapping using appropriate tools and platforms.

Evaluate the feasibility and effectiveness of various techniques through experimentation and testing.

System Design:

Design the architecture of the Gesture Recognition-Based Virtual Mouse and Keyboard system, including components, modules, and interfaces.

Define data flow, communication protocols, and integration points with external hardware and software.

Specify algorithms, data structures, and computational requirements for gesture detection, classification, and translation.

Development:

Implement the software components of the system based on the design specifications.

Develop modules for gesture detection using computer vision techniques and machine learning algorithms.

Implement virtual mouse control and keyboard input functionalities, including gesture classification and mapping.

Integrate feedback mechanisms, customization options, and compatibility features into the system.

Testing and Quality Assurance:

Conduct unit testing, integration testing, and system testing to validate the functionality and performance of the system.

Perform usability testing with end-users to gather feedback and identify areas for improvement.

Ensure the system meets quality standards, including accuracy, responsiveness, and robustness in various operating conditions.

Documentation:

Document the design specifications, implementation details, and user manuals for the Gesture Recognition-Based Virtual Mouse and Keyboard system.

Provide technical documentation for developers, including APIs, SDKs, and integration guidelines.

Create user guides and instructional materials to help end-users understand how to use the system effectively.

Deployment and Integration:

Prepare the system for deployment on target platforms and environments, ensuring compatibility and stability.

Provide installation packages or deployment scripts for easy setup and configuration.

Integrate the system with existing hardware setups, operating systems, and software applications as required.

Maintenance and Support:

Establish procedures for monitoring, maintenance, and troubleshooting of the deployed system.

Provide ongoing support and updates to address issues, add new features, and improve performance.

Offer training and technical assistance to end-users and administrators to maximize the benefits of the system.

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III. PROPOSED SYSTEM

The Mouse uses a convex hull or a mouse tracking module process for its working, defects are captured or read, using this defects 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. The process used for this keyboard function is a bit different than the Convex hull process, here the hand position system is used that is, the video that is capturing used the position of the hand is captured by the computer. In the open video window a miniature virtual keyboard is mapped. Using the hand position technique the keyboard functions can be selected which have been mapped and using this process the keyboard function executed, a math function is used to judge the position of the hand and turn it into a matrix location which makes the position recognisable for the computer.

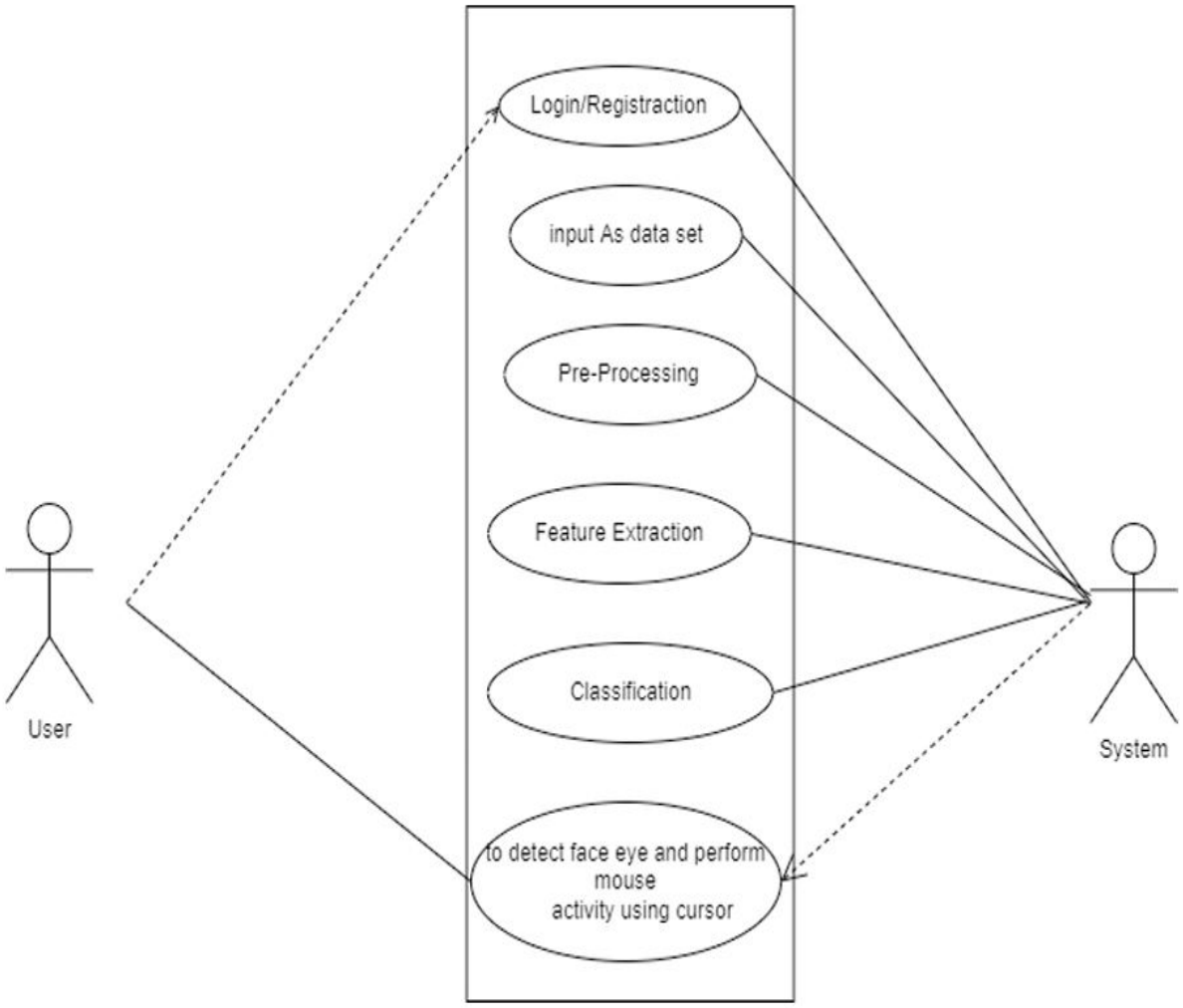

Fig 1.1

Here we use some of the python libraries such as numpy ,CV2, Tkinter ,PIL(pillow library), pandas etc. For keyboard we will use the haar cascade algorithm , the haar cascade algorithm is a machine learning based algorithm used for object detection in images and in video streams. This algorithm is very effective in real time face or object detection.

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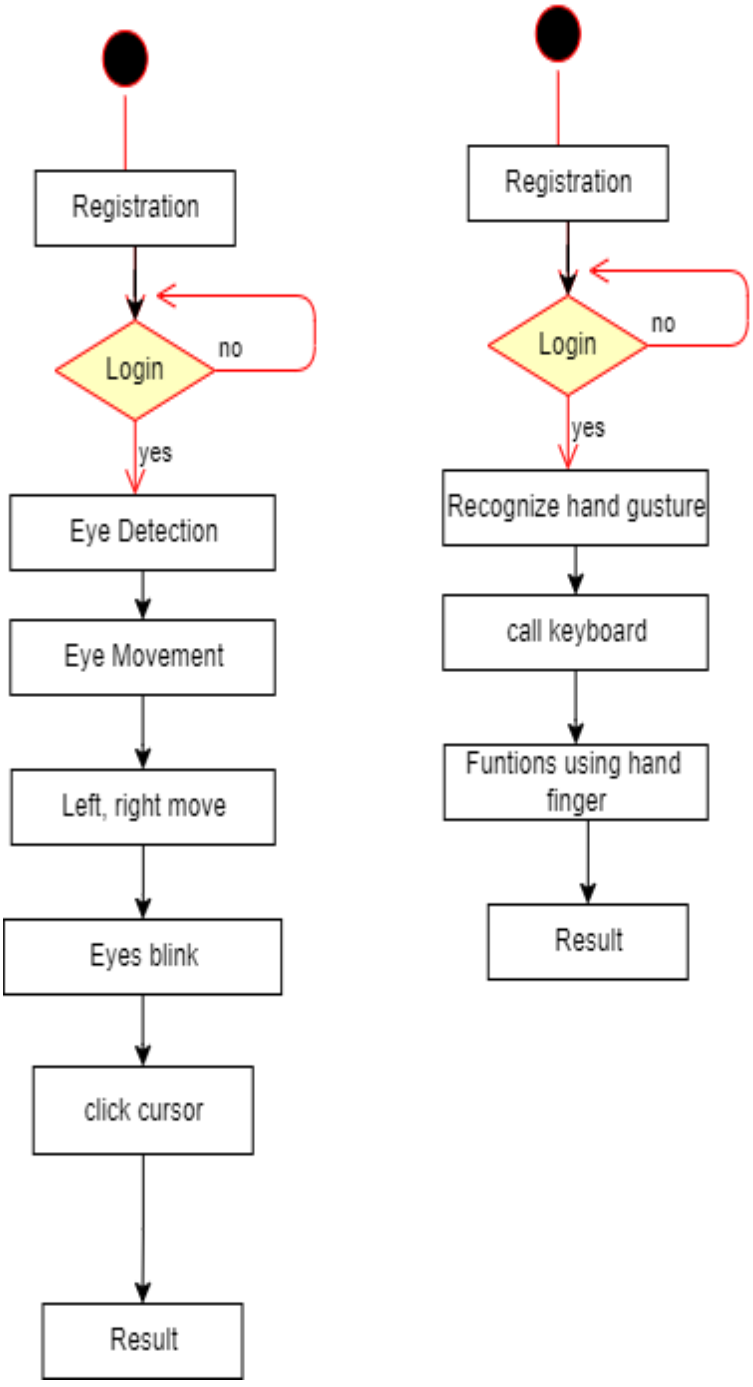

Fig.1.2

The Gesture recognition based virtual mouse and keyboard System represents a revolutionary fusion of innovation and technology. With the traditional physical mouse and keyboard experience becoming less efficient and the shift towards virtual mouse and keyboard, the need for a virtual solution that enables customers to experience this technology.

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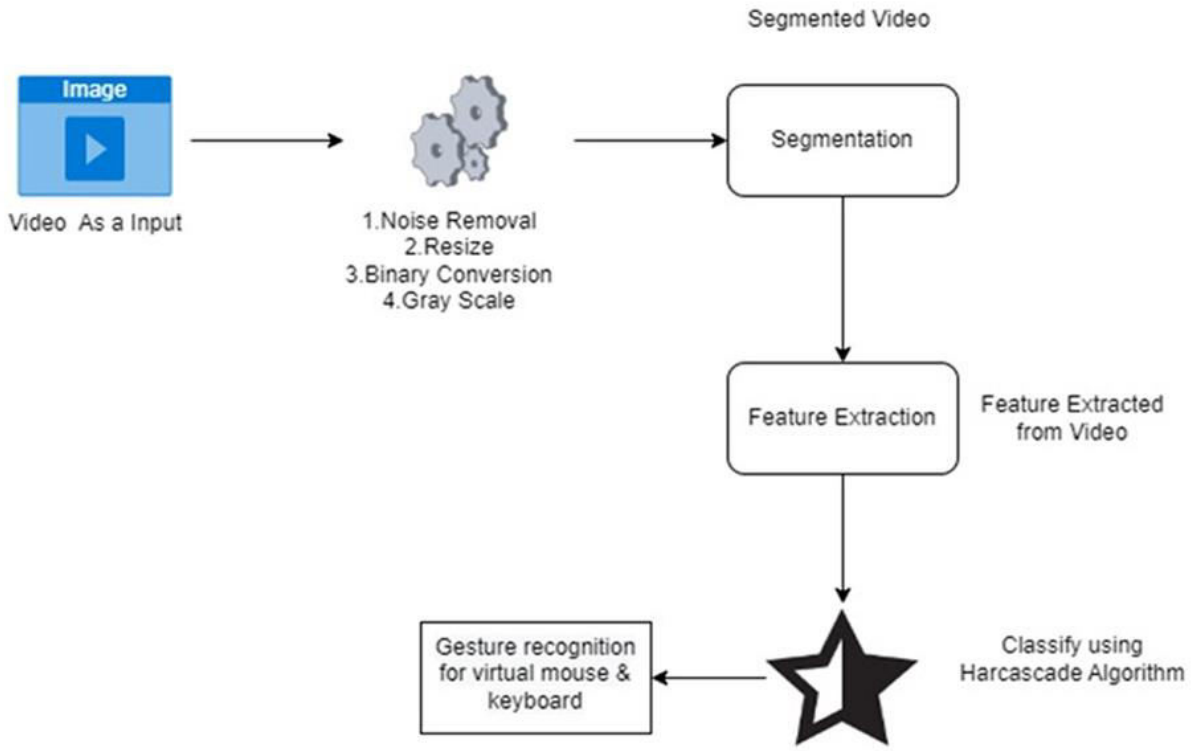

Fig 1.3

Initially the user has to login or signup if the user is new once the registration is done the user will sign in . Once the user in logged in the camera will start functioning . For the virtual mouse the head and eye movement will be captured for this we will be using python and its libraries and computer vision.

For virtual keyboard we will be using the hand tracking module and the haar cascade algorithm the virtual keyboard will be displayed on the screen the haar cascade algorithm here proves to be the most efficient when comes to object identification.

IV. CONCLUSION

In conclusion, the Gesture Recognition-Based Virtual Mouse and Keyboard system represents a significant advancement in human-computer interaction, offering users a futuristic and intuitive way to navigate digital environments and input text without physical input devices. By harnessing the power of computer vision, machine learning, and real-time processing, this system provides seamless control over cursor movements and keyboard inputs through hand gestures alone.

With its ability to accurately detect and interpret a wide range of hand movements, the system enables users to perform mouse actions such as cursor movement, left-click, right-click, and scrolling, as well as type text using virtual keyboard interfaces activated by gestures. This technology not only enhances user experience but also opens up new possibilities for accessibility, allowing individuals with physical disabilities or limitations to interact with technology more effectively.

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INTERNATIONAL STANDARD SERIAL NUMBER INDIA

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