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Hand Guided Mouse Simulator

Prof. Manisha Khadse, Sayali Bankar, Harsh Sonar, Saurabh Patil, Anushka More

Department of Computer Engineering, Dr. D. Y. Patil Institute of Engineering, Management and Research, Pune, India

ABSTRACT: The progression of computer interfaces from basic punch-card systems to keyboards, mice, and touch screens has aimed at enhancing user interaction. However, these traditional input methods come with limitations and user inconveniences. To overcome these challenges, the Hand Gesture Mouse Interface has been developed. This system utilizes a webcam to capture users' hand gestures, interpreting them as commands for various computer functions like left-click, right-click, and scrolling. By focusing on hand movement relative to the camera, the interface ensures accurate gesture recognition. Unlike conventional mouse operations, this approach simplifies interaction, offering a cost-effective and intuitive alternative. The primary objective is to streamline computer interaction by harnessing the power of hand gestures, making computing more accessible and user-friendly for all individuals.

KEYWORDS: Computer Vision, ML Algorithms (K-Means), Hand Gesture Recognition, Image Recognition, Non-Verbal Communication.

I.INTRODUCTION

This project is a detailed exploration and implementation of a hand gesture-controlled computer mouse system, emphasizing a thorough examination of both hardware and software components crucial for accurately capturing and interpreting hand gestures. The primary objective is to develop a user-friendly, reliable, and efficient gesture recognition system. This will be achieved through the integration of various sensors and algorithms to convert hand movements into mouse cursor actions. The project aims to contribute significantly to the field of human-computer interaction and accessibility technology. The report will comprehensively cover the methodology employed, the intricate design considerations, rigorous testing procedures, and the wide array of potential applications. The ultimate goal is to advance the understanding and application of gesture-based interfaces, enhancing the overall user experience and accessibility of computer systems.

This project is dedicated to developing a hand gesture-controlled computer mouse system, focusing on the design and implementation aspects. The goal is to investigate a range of hardware and software elements essential for accurately capturing and interpreting hand gestures. The project's primary objective is to create a gesture recognition system that is user-friendly, dependable, and efficient. By leveraging a combination of sensors and algorithms, the system will be able to translate hand movements into corresponding mouse cursor actions. This comprehensive report will delve into the project's methodology, design process, testing procedures, and potential applications. Ultimately, the project aims to make a valuable contribution to the field of human-computer interaction and accessibility technology.

This project center on designing and implementing a computer mouse system controlled by hand gestures. We'll examine different hardware and software parts to accurately capture and interpret hand gestures. The project aims to create a user-friendly, dependable, and effective gesture recognition system. By using sensors and algorithms, the system will convert hand movements into mouse cursor actions. This report will discuss the project's approach, design, testing, and possible uses, aiming to advance the field of human-computer interaction and accessibility technology.

II.LITERATURE REVIEW

Sr No	Paper Title	Publication Year	Authors and Publication Date	Methodology
1	Hand Gesture Mouse Interface System	2014	Verghese Koshy Puthukkeril, EH Shyam Sundar, PR Nandha Kumar 01 Sept 2014	Look at the raw data available to us and study it in-order to identify suitable attributes for research of techstack.

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2	Touchless Head-Control (THC): Head Gesture Recognition for Cursor and Orientation Control	2022	Wahyu Rahmaniar, Alfian Ma'arif, Ting-Lan Lin 2022	The touchless techniques in human-computer Interaction (HCI) can effectively expand computer access capabilities for disabled people.
3	Vision-Based Interpretation of Hand Gestures for Remote Control of a Computer Mouse	2006	Antonis A. Argyros and Manolis L.A. Lourakis 2006	Two different hand gesture vocabularies were proposed for remotely operating the mouse of a computer.
4	Mouse Cursor Control System Based on Hand Gesture	2015	Horatiu-Stefan Grif, Cornel Cristian Farcas 9-Oct 2015	Application has advantage of using color detection for gesture interpretation because it can be in low or high intensity light
5	Hand Gesture Controlled Virtual Mouse Using Artificial Intelligence	2023	Kavitha R, Janasruthi S U, Lokitha S,Tharani G 2023	With additional voice assistant support, Al virtual mouse using hand gestures can further enhance the user experience.

III.METHODOLOGY OF PROPOSED SURVEY

1) PROPOSED METHOD

- Project inspired by the growing need for enhanced human-computer interaction
- Motivated by the desire to offer users a more intuitive and accessible means of controlling their computers
- Conventional input devices can be limiting, especially for individuals with mobility impairments or in scenarios where traditional mouse usage is impractical
- Development of a hand gesture-controlled computer mouse to bridge these gaps and make computing more user-friendly
- Main objective: to develop an alternative to traditional mouse systems using a webcam to capture hand gestures for controlling mouse functions
- Prioritization of accuracy in recognizing gestures to ensure reliable interpretation of users' actions
- Focus on providing an accessible and user-friendly learning process to make gesture usage intuitive for all users
- Consistency across different applications for a seamless user experience
- Utilization of contextual and natural gestures to mimic real-world actions and make interactions more intuitive
- Integration with voice and touch controls for a versatile and adaptable input experience
- Seamless transition between input methods to enhance user flexibility and convenience

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2) CONTROLLING COMPUTER USING HAND GESTURES:

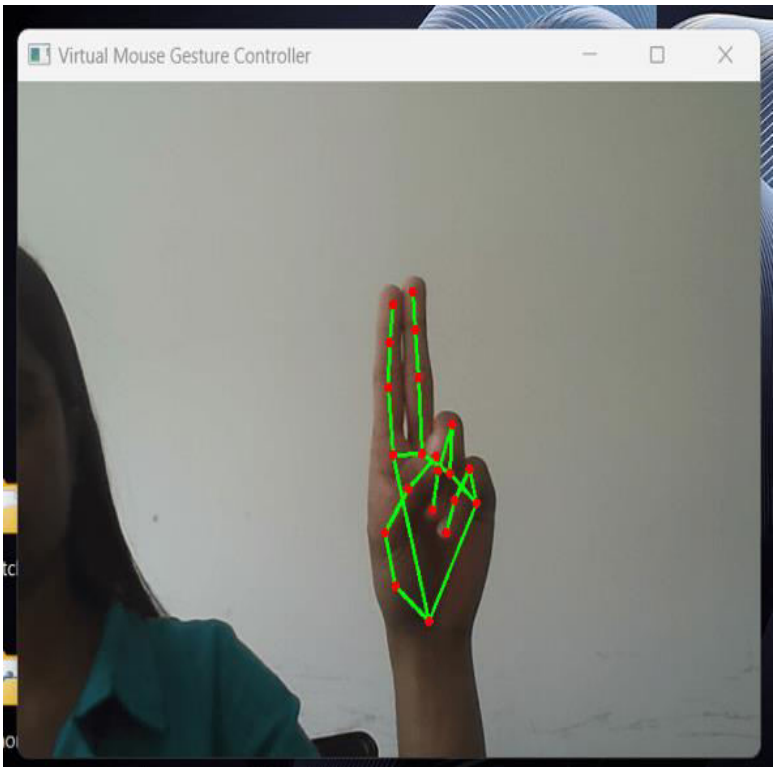

Fig. 01 Double Click

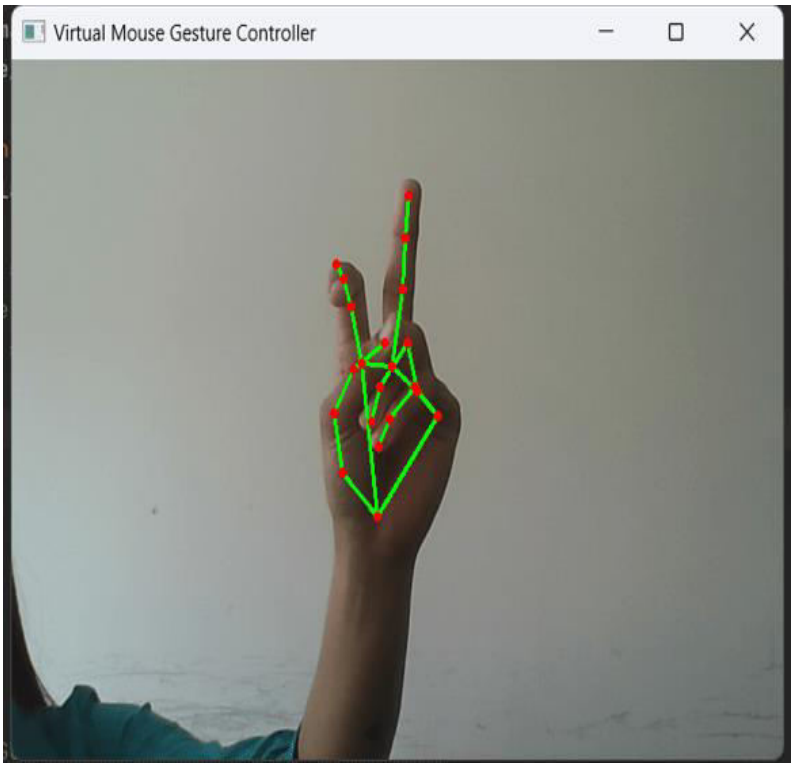

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Fig02. Left Click

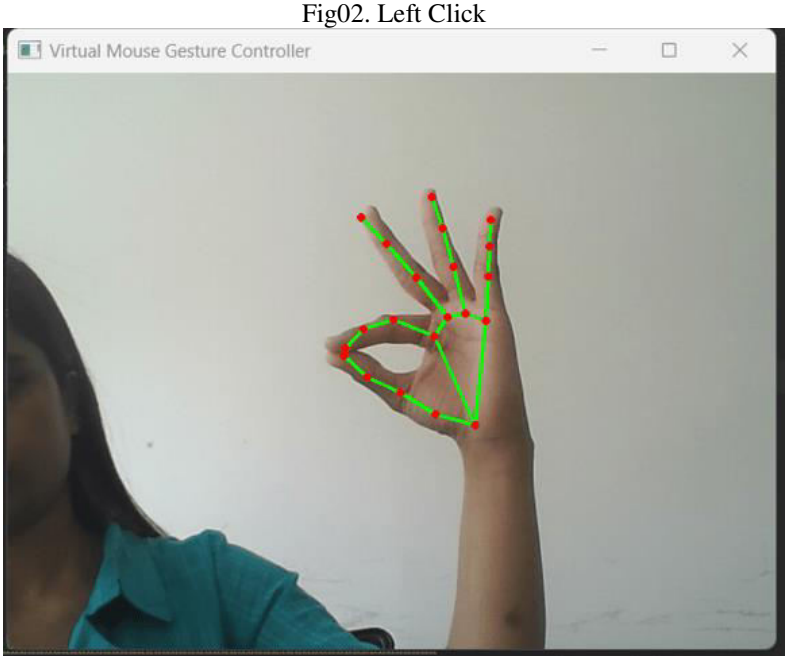

Fig03. Scroll

IV.ARCHITECTURE

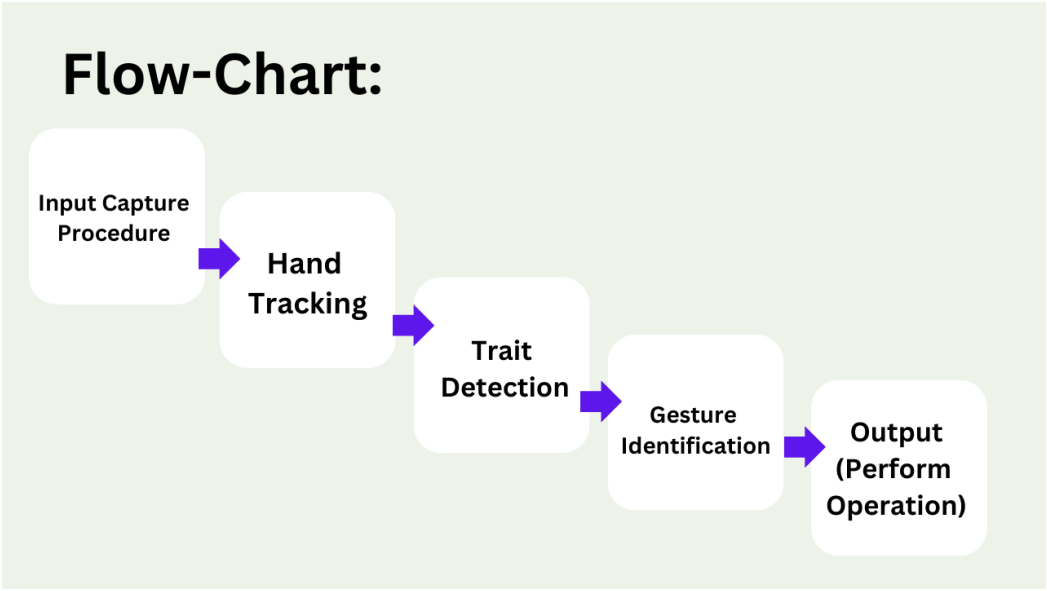

Fig 1. Architecture Of Hand Gesture Mouse Control

Step 1- Image Frame Acquisition:
The initial step in implementing the Hand Gesture Mouse Interface is image frame acquisition. This involves capturing frames from the webcam in real-time to gather data on hand gestures performed by the user.

Step 2 - Hand Gesture:
In the interaction scenario, an individual executes distinct hand gestures within the proximity of a camera or sensor embedded in a device. These gestures encompass a spectrum of movements, positions, or signs articulated through hand motions. Each gesture carries its unique significance, contributing to the nuancedlanguage communicated to the system.

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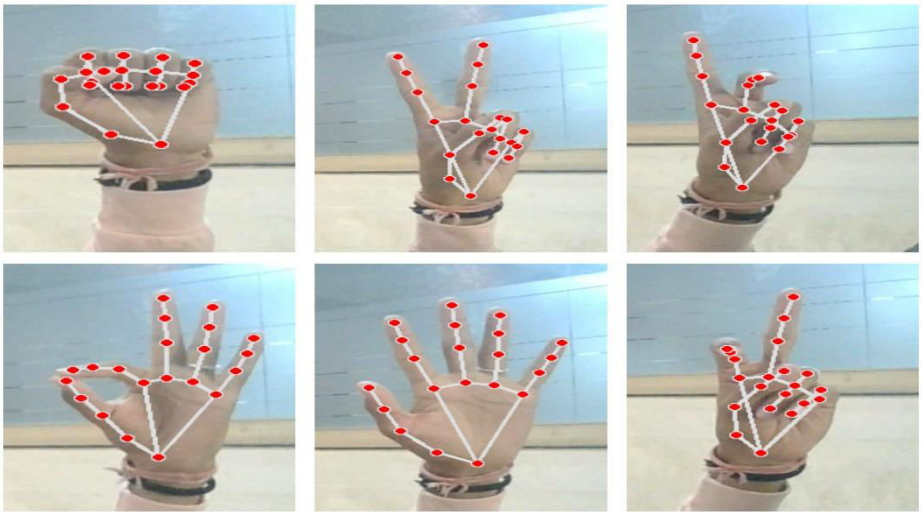
Step 3 - Image Captured by Device:
Upon execution, the device's camera swiftly captures either a single image or a sequence of images encapsulating the intricacies of the performed hand gesture. Subsequently, the device's software meticulously processes these images, dissecting the visual data to discern the essence and intent behind the gesture's manifestation.

Step 4 - Action to be Performed Based on Hand Gestures:
In this stage of the process, the software embedded within the device undertakes a meticulous analysis of the captured images, aiming to discern and interpret the
intricate nuances of the hand gesture presented. Drawing from its programmed algorithms, the software identifies the specific gesture enacted by the user. Depending on the recognized gesture, the device is then primed to execute a predefined action, such as propelling the car forward or applying the brakes withprecision and responsiveness.

4. Working
We tried to use the available dataset, but we faced an overfitting problem. Thus we create our own dataset for training the model. We took a total of 8 different hand gestures to perform activities like opening WhatsApp, PowerPoint presentation, Microsoft Word, Microsoft Edge, Google Chrome, Video Player, Xbox, Paint, etc. We took a total of 3000 images for training, 2000 images for testing, and 500 images for validation.



V.RESULT AND CONCLUSION

The Gesture-Controlled Virtual Mouse project represents a groundbreaking advancement in human-computer interaction, transcending the confines of conventional input methods. By harnessing intuitive gestures, it opens doors to a realm of enhanced precision, unparalleled freedom of movement, and heightened accessibility for users of all abilities. This innovation holds the promise of revolutionizing not just the way we navigate digital interfaces, but also the very essence of computing itself. Particularly, in the realm of healthcare, its implications are profound, offering relief to IT professionals plagued by back pain stemming from prolonged computer usage. With this technology, tasks that once required repetitive motions and fixed postures can now be executed with fluidity and grace, mitigating strain and promoting ergonomic well-being. In essence, the Gesture-Controlled Virtual Mouse project stands at the forefront of a transformative wave, poised to redefine the landscape of human-computer interaction and improve the lives of countless individuals worldwide.

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