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RESEARCH ARTICLE OPEN ACCESS

Virtual Keyboard and Mouse using Python

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Abstract:

In the era of touchless and remote interactions, virtual input devices have gained significant importance. This paper presents the development of a Virtual Keyboard and Mouse using Python, enabling users to interact with their computer through hand gestures and object tracking. The system leverages computer vision techniques, primarily using the OpenCV library, and hand tracking models from MediaPipe to detect hand movements. Gesture recognition allows users to simulate mouse actions such as clicking, scrolling, and dragging, while an on-screen keyboard provides text input functionality. The implementation ensures real-time responsiveness and accuracy, enhancing user experience and accessibility. This project can be beneficial in scenarios where physical input devices are unavailable or impractical, such as touchless interfaces, assistive technology, and gaming applications.

Keywords — **Virtual Input, Hand Tracking, Python, OpenCV, MediaPipe, Gesture Recognition, Assistive Technology**

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I. INTRODUCTION

Traditional input devices such as keyboards and mice have been the primary means of human-computer interaction for decades. However, with the advancement of computer vision and artificial intelligence, virtual input systems have emerged as a modern alternative, providing a touchless and intuitive way to interact with computers. A virtual keyboard and mouse

implemented using Python offers a non-physical, gesture-based approach to performing input tasks, making computing more accessible and interactive.

This project utilizes computer vision and hand-tracking algorithms to enable users to control a virtual mouse and keyboard using hand gestures. The system employs OpenCV for image processing and MediaPipe for real-time hand tracking, allowing users to move the cursor, click, scroll, and type using predefined gestures. The virtual keyboard displays an on-screen interface that responds to finger movements, mimicking the functionality of a physical keyboard.

The primary motivation behind this project is to create a contact-free input method that can be useful in various scenarios, including assistive technology for differently-abled users, public touchscreen systems, gaming, and interactive presentations. By eliminating the need for

physical input devices, this system enhances hygiene, accessibility, and user convenience.

This paper explores the methodology, implementation, and potential applications of the virtual keyboard and mouse, highlighting its advantages and challenges in real-world usage.

- **Virtual Mouse:** Virtual Mouse technology revolutionizes computer interaction by leveraging MediaPipe and OpenCV for accurate hand gesture detection. Through precise hand landmark detection and gesture mapping, users can seamlessly control applications and games using hand movements. This technology enhances accessibility for individuals with mobility impairments and finds applications in gaming and virtual reality environments, making computing more intuitive and user-friendly.

- **Virtual Keyboard:** Virtual Keyboard technology provides an alternative input method by simulating a physical keyboard on a digital interface. By utilizing MediaPipe and OpenCV, it detects hand gestures to interact with virtual keys, enhancing accessibility for individuals with mobility limitations. This technology offers customizable layouts and gesture recognition, enabling users to input text and commands seamlessly without a physical keyboard. It finds applications in touch-based devices, assistive technologies, and environments where traditional keyboards are impractical.

II. LITERATURE SURVEY

1. Authors : Kavitha R , Janasruthi S U , Lokitha S , Tharani G

The use of hand gesture recognition in controlling virtual devices has become popular due to the advancement of artificial intelligence technology. A hand gesture-controlled virtual mouse system that utilizes AI algorithms to recognize hand gestures and translate them into mouse movements is proposed in this paper. The system is designed to provide an alternative interface for people who have difficulty using a traditional mouse or keyboard. The proposed system uses a camera to capture images of the user's hand, which are processed by an AI algorithm to recognize the gestures being made. The system is trained using a dataset of hand gestures to recognize different gestures. The model is implemented using CNN and mediapipe framework. This system has potential applications like enabling hand-free operation of devices in hazardous environments and providing an alternative interface for hardware mouse. Overall, the hand gesture-controlled virtual mouse system offers a promising approach to enhance user experience and improve accessibility through human computer interaction.

2. Authors : Naresh Thoutam, Bhumi chavan, Kabir Patole, Sakshi Jadhav, Vidhya Bagal

In this project, an optical mouse and keyboard are created utilizing hand motions and computer vision. The computer's camera will scan the image of various hand gestures made by a user, and the computer's mouse or pointer will move in accordance with the movements of the Users can even conduct right and left clicks using various gestures. Similar to this, several gestures can be used to operate the keyboard, such as the one-finger gesture for selecting an alphabet and the fourfigure motion for swiping left and right. Without a wire or other external devices, it will function as a virtual mouse and keyboard. The project's webcam is its sole piece of hardware, and Python is used to code on the Anaconda platform. Here, the Convex hull defects are first constructed, and then an algorithm is generated and maps the mouse and keyboard functions to the defects using the defect calculations. By mapping a few of them with the mouse and keyboard, the computer will recognise the user's gesture and respond appropriately.

3. Authors : Pooja S Kumari Verma , Sucharitha Mahanta, Sevanth B N, Assistant Prof. Shreedhar B

Human-computer interaction has changed since the advent of computer technology. Gestures are a useful way to communicate, and the Covid-19 era had an impact on us. Both the keyboard and the mouse are tools used to communicate with computers. Here, we've attempted to use hand gestures to interact with the mouse and keyboard. Eventually, get rid of the electronics. Consequently, use a virtual keyboard and your finger to move the mouse cursor. Using different hand gestures, actions like clicking, dragging, and typing data will be carried out. A webcam is the IOT device required to accomplish this. The output from the camera will be displayed on the system's screen so that the user can fine-tune it. We employ tools like Python, Media- Pipe, and Open-CV. The Media-Pipe library offers features that improve the model's effectiveness and is particularly helpful in AI projects.

4. Authors : Pratiksha Kadam, Prof. Minal Junagre, Sakshi Khalate, Vaishnavi Jadhav, Pragati Shewale

The field of computer vision has advanced significantly, enabling computers to identify their users using simple programs based on image processing. This technology has been widely used in various day-to-day applications, such as face recognition, color detection, and autonomous driving. This research project aims to use computer vision to develop an optical mouse and keyboard that can be operated through hand movements. The computer camera will capture images of different hand gestures made by the user, and the mouse pointer or cursor on the computer screen will move accordingly. Different hand gestures can be used to execute right and left-clicks. Similarly, the keyboard functions can be performed using different hand actions, such as using a finger to select an alphabet and a four-digit swipe left or right. The virtual mouse and keyboard can be used wirelessly or externally, and the only hardware required for the project is a webcam.

5. Authors : Chinnam Datta Sai Nikhil, Chukka Uma Someswara Rao, E.Brumancia, K.Indira, T.Anandhi, P.Ajitha.

Hand motion acknowledgment is critical for human- PC connection. Right now, present a novel constant strategy for hand motion recognition. The proposed framework is vision based, which uses AI methods and contributions from a PC webcam. Vision based signal acknowledgment following and motion acknowledgment In our structure, the hand area is separated from the foundation with the foundation subtraction technique. At that point, fingers are portioned in order to identify and perceive the fingers. At long last, a standard classifier is applied to anticipate the names of hand motions. The examinations on the informational index of 1300 pictures show that our strategy performs well and is exceptionally productive. Besides, our technique shows preferred execution over a condition of-workmanship strategy on another informational collection of hand motions.

6. Authors : Khushi Pathak, Aniket Joshi, Aryan Kalra, Shraddha Patil, Rajendra V. Babar

explores the advancement of Virtual Mouse Hand Gesture technology, utilizing MediaPipe and OpenCV for real-time hand gesture recognition. MediaPipe, developed by Google, enables accurate hand landmark detection, while OpenCV refines gesture recognition through noise reduction techniques. The detected gestures are mapped to specific mouse actions through mathematical algorithms, with trigonometric calculations ensuring precise cursor movement. Using PyAutoGUI, the system translates these gestures into interactive commands, allowing users to control applications, games, and graphical interfaces seamlessly. The study highlights the significance of this technology in accessibility, particularly for individuals with mobility impairments, and its applications in gaming, virtual reality, and interactive multimedia systems. By integrating MediaPipe and OpenCV, the research demonstrates how gesture-based

interaction can enhance user experience, making computing more intuitive and user-friendly.

III. ALGORITHMS AND LIBRARIES USED

MediaPipe:

In the project, MediaPipe serves as a essential issue for real-time hand landmark detection and gesture popularity. MediaPipe presents superior algorithms and fashions for appropriately figuring out key factors at the hand, allowing particular gesture popularity in the digital interface. By leveraging MediaPipe`s capabilities, the machine can interpret complicated hand moves and translate them into corresponding actions, which include controlling the digital mouse cursor, executing keyboard inputs, or adjusting the extent level.

OpenCV:

OpenCV performs a multifaceted position withinside the project, basically specializing in digital digicam configuration, body acquisition, and preprocessing tasks. It allows the initialization and configuration of the internet digital digicam for video capture, making sure a consistent flow of frames for analysis. Moreover, OpenCV plays crucial preprocessing tasks, consisting of shadeation area conversion and noise reduction, which decorate the nice and reliability of hand gesture detection and popularity.

PyAutoGUI:

PyAutoGUI serves as a vital factor for simulating person interactions primarily based totally on detected hand gestures. PyAutoGUI permits the machine to simulate mouse movements, keyboard inputs, and extent changes in reaction to identified gestures, efficiently bridging the distance among gesture reputation and machine moves. By translating detected gestures into unique moves in the digital interface, PyAutoGUI guarantees seamless and intuitive person interaction, improving the general usability and accessibility of the machine.

IV. CONCLUSION

In this paper, we've supplied a complete exploration of a digital mouse, keyboard, and quantity manage gadget operated thru hand gestures. Our research underscores the transformative ability of human-pc interplay technologies, specially in improving accessibility and person engagement. Through integration of MediaPipe and OpenCV, our gadget achieves unique hand gesture popularity and real-time interplay, presenting customers with an intuitive and immersive computing experience. PyAutoGUI`s position in simulating mouse and keyboard moves primarily based on detected gestures amplifies the gadget's usability and functionality. This studies now no longer simplest demonstrates the feasibility and efficacy of gesture-primarily based totally interplay however additionally opens avenues for similarly innovation in accessibility technology, gaming, digital reality, and multimedia systems. By publishing this paper, we intention to make contributions to the continued discourse on human-pc interplay and encourage destiny traits in handy computing interfaces, in the end enriching the lives of various person communities.

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