Virtual Mouse Using A.I Assist For Disabled

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***Abstract*—Virtual mouse using voice command is a system designed to enable individuals with disabilities to control their computer devices without the use of a physical mouse. The system utilizes voice recognition technology to interpret user commands, allowing the user to navigate their computer screen, launch applications, and perform other tasks. This technology is particularly useful for individuals who may have difficulty using a traditional mouse or keyboard, such as those with limited dexterity or mobility. By providing an accessible and intuitive method for computer navigation, virtual mouse using voice command has the potential to improve the quality of life and independence for individuals with disabilities. Also the disabled instead of using keyboard for typing, is able to use the voice assist for convert the speech into text which will be more convenient to use.**

I. Introduction

A virtual mouse using voice assist is a technology that allows individuals with disabilities to control their computers or other electronic devices using their voice. Instead of using a physical mouse, users can navigate their devices and perform functions by speaking commands, which are interpreted and executed by the virtual mouse.

This technology is particularly helpful for individuals with physical disabilities that make it difficult or impossible to use a traditional mouse. By using their voice, these individuals can interact with their devices in a more natural and intuitive way, allowing them to access information, communicate with others, and perform other tasks that might otherwise be difficult or impossible.

In addition to enhancing accessibility, virtual mouse technology can also improve efficiency and productivity for all users, as it allows for hands-free operation and can save time by eliminating the need to physically move a mouse.

II. Ease of use

A. Solution for the finger tracking in the real world and the control of cursor

Touchscreens are shows which could hit upon the touch of a finger on their floor and translate it into input for a laptop or other tool. This allows customers to manipulate the device through touching the display, making it an powerful solution for finger monitoring and cursor manipulate. Touchscreens are typically used on smartphones, pills, and laptops, in addition to in interactive kiosks, gaming systems, and different applications.

III. Literature Survey

In recent years, researchers have investigated a variety of approaches to hand recognition and gesture recognition.

The work by R. M. Prakash [1] successfully recognizes five different gestures and detects finger tips using region growing segmentation and convex hull algorithm, and has the potential to be extended for real-time mouse control operations in the future.

The work by R. S. Batu [2]The purpose of this project is to provide mouse control using color assisted eye movements for people who are uncomfortable with mouse use. can serve different sectors in the field of image processing.

The work by K. Wang [3]a review of image copy-move forgery detection algorithms based on spatial feature domain, proposes a new algorithm that has improved accuracy in detecting copy-move forgeries, and concludes that using spatial feature domain analysis is a promising solution for detecting such forgeries, despite potential false alarms in some cases and difficulties in handling more complex forgeries.

The work by R. Elakkiya [4] vision algorithm uses skin segmentation, convex hull and corner detection, and a multilayer feed forward neural network to recognize hand gestures for controlling media player without the need for special

tools, achieving an average classification rate of 95%, and has the potential to be extended for controlling TV and mobile applications in the future.

The work by G.Meng [5] The method combines hand tracking, segmentation, and multi-scale feature extraction for accurate hand gesture recognition. It uses color and motion cues for adaptive segmentation and palm-finger decomposition for recognition. The method shows promising performance with various postures and backgrounds.

The work by A. Mhetar [6] Gesture recognition system of detection fingertips is based on contour approximation, not only effectively detect fingertips position and finger numbers, and but also can achieve real-time gesture recognition for 10 classes of gestures.

The work by M. Amjadi [7] proposed hand pointing gestures incorporated with other hand gestures in 3D space. We use two USB cameras which are placed orthogonal to each other to obtain top view and side view of different hand gestures.

The work by N. Shaker [8] The Virtual Gesture Control Mouse system guides the mouse cursor and performs tasks using a real-time camera and image comparison and motion detection technology, and has the potential to be further developed for additional features such as interaction in multiple windows and using palm and multiple fingers.

The work by Soeb Hussain [9] proposes a system developed using MATLAB, consisting of three independent units for static and dynamic hand gesture recognition and a virtual mouse, which has been verified using hands of different people and demonstrated in a physical implementation, with potential for extension to work in complex backgrounds and varying light conditions and function as a comprehensive user interface with all mouse . The work by Chen [10] in the context of e-learning, there is a need for better communication and interaction between teachers and students, which can be achieved through the use of technology-dependent resources, such as a proposed virtual marker that can also function as a mouse, and by exploring the HID functions of a high-end micro-controller to amplify its functionality.

The work by Javeria Farooq [11] proposes a finger motion detection glove that uses highly stretchable and linear strain sensors integrated with signal conditioning schemes to provide accurate and fast capturing speed, which is inexpensive, portable, wireless, light, simple to use, and has long working time, and has potential to become convenient to use for human-machine interface based on finger motion detection.

The work by Stefan Oniga [12] The finger's peak was detected accurately when the hand is not rotated more than 450 around the y-axes -the vertical axes- for the above images, and not rotated more than 450 around the x- axes -horizontal axes- for side images. In tracking mode the results were very robust when the frame rate is 20 fps and higher.

The work by Jong-Min Kim [13] Propose a vision based hand gesture recognition method using transfer learning. The method was made robust by avoiding skin color segmentation, blob detection, skin area cropping and centroid extraction for unidirectional dynamic gestures. Prototype was tested successfully on seven different volunteers at different backgrounds and light conditions with an accuracy of 93.09%.

The work by Sandeep Thakur [14] The program detects the hand region using the background subtraction method and recognizes hand gestures using a simple rule classifier, with promising results for real-time applications.

The work by Tsung-Han Tsai [15] propose a new kind of simulated mouse based on the dynamic hand gesture recognition.

The work by Sherin Mohammed Sali Shajideen [16] Hand gesture recognition improves interaction systems by offering a natural, flexible, and cost-effective way to control devices, although developing reliable algorithms using camera sensors requires effort due to potential issues and trade-offs.

The work by Kabid Hassan Shibly [17] explores three techniques for hand gesture recognition and concludes that the curvature of a perimeter is the most robust approach, with potential applications in various fields including music players, virtual mice, computer games, robot navigation, and touchless interaction with computers, and suggests further optimization by converting the algorithms into fixed point and generating C code for embedding into systems like DSP or FPGA.

The work by Ajith Jacob [18] The functionality of the system implementing the recognition of five basic gestures has been demonstrated: idle, left movement, right movement, up movement and down movement. Recognizing more gestures, the system will allow a greater degree of control and even a more intuitive control system for the end user. The system can also be controlled by hand tilting only, giving persons with a low degree of mobility a possibility to use the system.

The work by Xue Xue [19] The paper proposes a method for recognizing the direction pointed by the user using fingertip information detected from hand shape images and applies this method as a virtual reality interface, with successful results that can be useful in various fields.

The work by Kirti Aggarwal [20] A vision-based virtual mouse system is developed using color caps on fingers to track hand gestures, which is less expensive and has great potential for future use in fields such as robotics, biomedical instrumentation, and computer gaming.

A. *Proposed methodology*

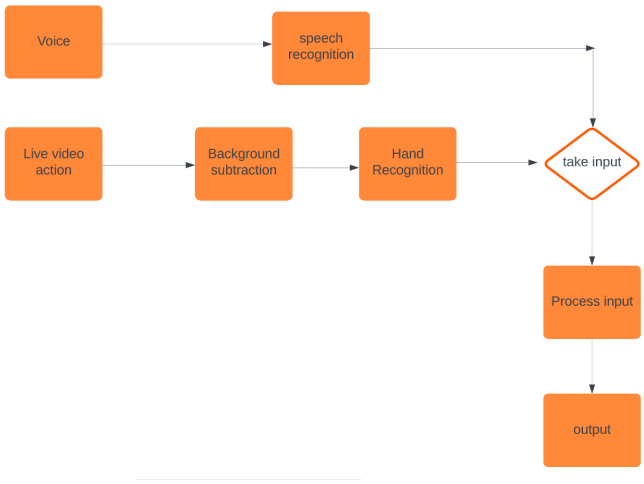

Fig. 1. Architecture

1) capture the live video recording : The usage of virtual mouse software program, you can manage your pcś cursor the usage of your webcam. A virtual mouse facts your hand moves and converts them to cursor movements on your laptop screen the use of your webcam.

Steps typically involved in the process are as follows:

1. Set up your webcam as your video input supply by launching the virtual mouse software.

2.Using the on-screen commands to calibrate the software by way of positioning your hand inside a chosen location on the display and appearing positive gestures to establish a baseline.

3. Video recording entails your webcam constantly shooting your hand movements whilst you circulate them closer to the digicam.

4. Changing the video feed into cursor movements on the screen in real-time.

5.First-class-tuning the settings to optimize the performance of the software program.

Video capturing in a virtual mouse is a important aspect of the generation, as it lets in for accurate and responsive cursor manipulate based at the user's hand movements.

2) background subtraction: In digital mouse software, backdrop subtraction is a way for setting apart the person's hand motions from the background scene being recorded by the digicam. Historical past subtraction is used to split the hand motions from the backdrop, that could have a huge range of colors, textures, and lighting fixtures situations and might have an effect on the precision of the cursor manipulate.

The tiers under are generally blanketed in the historical past subtraction procedure:

1. The use of the webcam with out the consumer's hand in the image to seize the background. 2. Inspecting backdrop photograph in contrast to following webcam-shot frames of video. 3. Getting a foreground image by way of subtracting the heritage photo from the present day body of video, which separates the user's hand motions from the backdrop. 4.The use of filters and other photograph processing strategies to increase the foreground picture's pleasant and the cursor manipulates precision. 5. Utilizing the foreground picture to find and music the user's hand, that is finally transformed into screen cursor motions. Virtual mouse software program can successfully clear out the backdrop surroundings and deal with the person's hand motions through using heritage subtraction, which ends up in more particular and responsive cursor manipulate.

3) recognition of hand and gestures: Digital mouse generation permits users to manipulate their pc cursor using hand motions and gestures. Two fundamental components of this era are hand popularity and gesture recognition.

Hand identity includes identifying the person's hand in pictures that turned into obtained by the camera using picture processing algorithms. To find a hand and become aware of it from different objects in the subject of vision, this commonly entails analyzing the shape, colour, texture, and movement of the pixels inside the video.

Gesture popularity is used to read the user's hand motions and rework them into cursor actions on the display screen as soon as the user's hand has been diagnosed. Virtual mouse era allows users to govern their pc cursor using hand motions and gestures. Two most important components of this era are hand recognition and gesture popularity.

Hand identification includes figuring out the consumer's hand in footage that turned into received by way of the camera the use of photo processing algorithms. To discover a hand and identify it from other gadgets in the discipline of vision, this commonly entails inspecting the shape, coloration, texture, and movement of the pixels in the video.

Gesture recognition is used to read the person's hand motions and rework them into cursor movements on the display screen once the user's hand has been recognized.

4) process the input from live video recording: With video capture gadget, inclusive of a webcam or camera, customers' palms or different enter devices are recorded on video as they pass. To take away any background noise or undesired motions, the recorded video may be edited and filtered.

Image processing: To pick out the region and movement of the consumer's hand or enter device, the accumulated video frames are analysed the use of computer vision algorithms. Studying the colors, shapes, and moves of the recorded images is needed for this.

Movement translation: The virtual mouse pointer on the display screen is moved primarily based on the placement and movement of the consumer's hand or input tool.

Click on and scrolling detection: in addition to monitoring movements, the program may also be able to understand whilst a consumer clicks, double-clicks, or scrolls the usage of an input tool. The sports of the digital mouse at the screen are managed the usage of this data.

Show: finally, the person's display screen shows the digital mouse cursor, enabling them to have interaction with their laptop the use of their hand or an input tool.

5) voice command and assist: working of voice command include: Voice Input: The user gives voice commands to the virtual mouse software application using a microphone. Speech Recognition: The virtual mouse software uses a speech recognition system to convert the user's spoken commands into text. Text Processing: The text received from the speech recognition system is then processed by the virtual mouse software to identify the specific command. Mouse Movement: Once the command has been identified, the virtual mouse software sends instructions to the operating system to move the mouse pointer in the desired direction or to perform a specific action such as a left-click or right-click.

The accuracy and responsiveness of the virtual mouse software depend on the quality of the speech recognition system and the processing algorithms used by the software. Some virtual mouse applications may also allow for customization of the voice commands to suit the user's preferences or to accommodate different languages or accents.

It also include the voice assist. Speech-to-text conversion, also known as speech recognition, is the process of converting spoken words into text. This technology can be used in various applications, including virtual mouse control.

In the context of a virtual mouse, the speech-to-text conversion process involves capturing the user's voice using a microphone and converting the spoken words into text using a speech recognition engine.

From user's voice, speech is enhanced, Speech enhancement is a technique used to improve the quality of speech signals that are corrupted by various forms of noise, such as background noise or interference from other sources. The objective of speech enhancement is to enhance the intelligibility and quality of the speech signal, making it easier for humans or machines to understand.

second comes the feature extraction. Feature extraction is the process of transforming the raw speech waveform into a set of features that can be used to represent and classify speech sounds. The goal of feature extraction is to capture the essential characteristics of the speech signal, while discarding irrelevant or redundant information.

next comes phonetic unit recognition along with acoustic modeling, Phonetic unit recognition involves identifying and categorizing the individual sounds or phonemes that make up spoken language. Acoustic modeling, on the other hand, involves modeling the relationship between the acoustic signal of speech and the phonetic units that it contains. The combination of these two components is essential for accurate speech recognition. The phonetic unit recognition provides the symbolic representation of the speech, while the acoustic modeling provides the statistical model that can map the acoustic signal to this symbolic representation. This allows the speech recognition system to accurately transcribe spoken language, even in the presence of noise, accents, or other sources of variability.

6) output: The movement and clicking of the mouse pointer at the pc display is the equal output of a digital mouse as it is of a real mouse. The motions that correspond to the consumer's input device actions are shown at the pc display screen when the user actions the virtual mouse pointer.The virtual mouse is able to perform basic functions of physical mouse like left click,right click, double click, up-scroll, down-scroll. At the laptop display, operations like commencing a file or selecting an object are finished whilst a consumer clicks or double-clicks with their hand. A similar scrolling motion is visible on the laptop display screen whilst the person scrolls the use of their enter device. Using voice assist, it convert the speech to text where use of keyboard can be avoided.

B. Some Common Mistakes

Errors in gesture monitoring and identification are regularly made in virtual mouse technologies, which can cause inadvertent cursor moves or selection blunders. Versions in hand form or placement, changes in lighting or backdrop, or any of this stuff is probably the basis of these errors. Lack of system flexibility is every other common blunders that would limit the variety of gestures or motions that can be diagnosed and utilised to govern the mouse cursor.

The usage of digital mice can also be limited by means of technological issues, which include the necessity for unique hardware or software program or a minimum quantity of processing energy or memory. Customers might also discover it extra challenging to get entry to or utilise digital mouse apps due to those regulations, which can also restrict the quantity of gadgets or structures on which the era may be used.

Work on growing the precision and adaptability in their gesture detection and tracking algorithms to reduce these mistakes. You have to also remedy any technological issues by using designing software program and hardware with more performance. To growth the general overall performance and value of digital mouse generation and to allow it to comprehend its full ability as a more herbal and approachable technique of human-laptop interplay, extra research and improvement will be required.

coming to speech recognition part, One common mistake in speech recognition is misinterpreting homophones, which are words that have the same pronunciation but different meanings. For example, ”to”, ”too”, and ”two” are all pronounced the same, but have different meanings. This can be a challenge for speech recognition systems, especially if the context is not clear or if there are other words with similar pronunciations in the surrounding text.

Another common mistake is misrecognizing out-of-vocabulary words, which are words that are not included in the speech recognition system's lexicon or vocabulary. This can happen if the user is speaking a rare or technical term, a name, or a word in a different language. In such cases, the system may either substitute a similar-sounding word from its vocabulary or simply produce an error.

A third common mistake is incorrect segmentation, which occurs when the system fails to properly distinguish between individual words or phrases in the speech input. This can lead to errors in the transcription and interpretation of the speech,

especially in cases where there are no clear pauses or other markers between words.

Other common mistakes include errors in identifying and filtering out background noise, variations in speech patterns due to accents or dialects, and errors in interpreting spoken punctuation and formatting cues. These challenges are being actively researched and addressed by ongoing advances in speech recognition technology.

IV. Experiments and Results

The experimental consequences confirmed that hand gesture popularity is rapid and accurate.The system was able to perform the basic function of a physical mouse. Voice assist for converting the speech to text is working with some misinterpreting homophones

Conclusion

In conclusion, the development of a virtual mouse using speech recognition technology has opened up new possibilities for individuals with disabilities, especially those who have limited or no control over their limbs. By simply using their voice, they can now easily navigate through computer interfaces and perform tasks that were once difficult or impossible. This innovative technology has the potential to revolutionize the way disabled individuals interact with computers, giving them greater independence and accessibility. However, further research and development are needed to improve the accuracy and efficiency of speech recognition technology and to ensure that it is accessible and affordable for everyone who could benefit from it.

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