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MANUS GESTURE CONTROLLED ROBOT

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Abstract: In this particular project, we are going to portray a robotic device that is mainly intended to be used in the field of Medical Supervision and Maintenance. This device is in the form of a four-wheeled vehicle that can cover a certain area of the floor of the hospital depending on the range of Bluetooth connectivity of the device. The device is also equipped with a camera which is used for viewing the path in which it is moving. The device's movements can be remotely controlled using OpenCV. The camera operates with WIFI and streams the data via the router to a web URL. The four-wheeled vehicle will move in four directions as Forward, Backward, Left and Right. In a normal situation, the device will loiter all around the floor of the hospital following the instructions. All sorts of communication between the User and the Device will be done using the Internet of Things Platform therefore the authority can monitor a certain situation closely.

Keywords: Manus, Gesture, human computer interaction (HCI), contour, convex hull, convexity defects, gesture recognition, python, OpenCV.

1.Introduction:

The World Health Organization (WHO) on January 30, 2020, publicly declared the COVID-19 pandemic as a "global emergency" because of the rapidity at which it had spread worldwide. The virus has wreaked havoc on the global economy, causing stock markets to plummet in a number of countries. Since the first cases were discovered in Wuhan, China, in December 2019, the coronavirus pandemic has spread fast throughout China and over international borders, causing several instances in practically every country except Antarctica.

Despite a lack of publicly available data, experts around the world have made headway in predicting the pandemic's size, rate of advancement, and varied transmission routes. Clinical evidence recently indicated that a considerable fraction of COVID-19 patients has mild symptoms for the first four days, demonstrating the contagious disease's stealthy transmission potential. COVID-19 is significantly more transmissible and dangerous than the common flu, according to scientists.

Because of the disease's extremely contagious nature, COVID-19 transmission can be pre-symptomatic, symptomatic, or asymptomatic. To avoid the viral infection, which can spread through sneezing, touching, and shaking hands, it is critical to use hand sanitizers, facemasks, and social distancing techniques. The use of personal protective equipment (PPE) such as N-95 facemasks and gloves to protect against the transmission of coronavirus is required for close monitoring of COVID-19 patients in the medical and healthcare community. To restrict the transmission of infection to a large population, alternative technologies such as medical robots and telemedicine systems are being considered.

• Direct interaction with patients in the hospital is now prohibited owing to COVID-19.

• We must maintain a physical distance of at least 1 meter, yet we cannot prevent passing utilities to patients.

• Making this work virtually is the solution to this challenge.

• The goal of our project is to create and deploy an autonomous machine that can deliver medicines and other necessities to specific patients in hospitals. We focused on the delivery of objects through gestures in this project.

• A four-wheel-drive robot with an array of infrared sensors is attached to the vehicle's base, allowing it to save the machine in the event of an obnoxious situation.

• A four-wheel-drive robot with an array of infrared sensors is put on the vehicle's base, saving the machine if any obstructions are encountered.

• OpenCV is used for training modules, and a camera is used to scan gestures. We can utilize the model to convey medicines and other utilities to COVID patients once it is complete. As a result, the patient is virtually connected to his family, doctor, and nurse.

One technology that can recognize a hand motion in real-time video is hand gesture recognition. Hand gestures are categorized according to their application.

One of the difficult responsibilities in this study is designing hand gesture recognition, which entails two key issues. The discovery of a hand is the first step. Another issue is making a sign that may be utilized for more than one thing. The first is the detection of a person's hand. Another issue is creating a sign that can only be utilized one hand at a time. This study focuses on how a computer vision system could detect, recognize, and interpret hand gesture recognition with problematic elements such as position, orientation, location, and scale. Different forms of gestures, such as numbers and sign languages, must be established in this system to function well in developing this project.

hand motion or, in other words, to detect the appearance of the hand in a frame. The detection of hands will be done in this project using the theories of Region of Interest (ROI) and Python programming. Because the source code to read the real-time input video is different for the hardware implementation, the description of the results will centre on the simulation aspect. The theories of hand segmentation and the hand detection system can be applied to the construction of hand gesture recognition utilizing Python and OpenCV.

These four-wheeled robots may be controlled from anywhere in the world. It uses a webcam to provide us with a live feed on our smartphones. Because this robot accepts input via gestures, even the deaf and dumb can use it to transport items from one person to another.

2.Hand Segmentation:

The process of extracting objects of interest from an image is referred to as segmentation. The user's hand is the object of interest in our scenario.

There are numerous techniques to solving this problem, each with varying degrees of difficulty and precision. We have to rule out segmentation algorithms based on thresholding grayscale pictures due to the lack of substantial constraints on the scene's composition and illumination. The grayscale analysis is not a viable alternative because our typical image histogram does not contain any discernible separation of modes, despite the fact that these approaches are generally fast and reliable (with the correct photos).

We determined that segmenting the hand beginning with the hue of the user's skin is the most complex and reliable technique to solving our challenge in terms of complexity and reliability. The concept is straightforward: identify the user's skin color and use it as a threshold to binarize the image.

Before image processing, the image taken from the real-time video is evaluated using contours to detect the user's hand is the object of interest in our scenario.

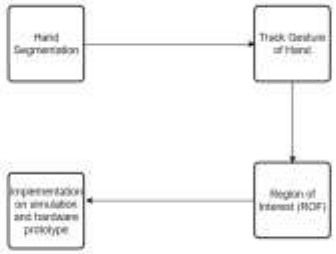
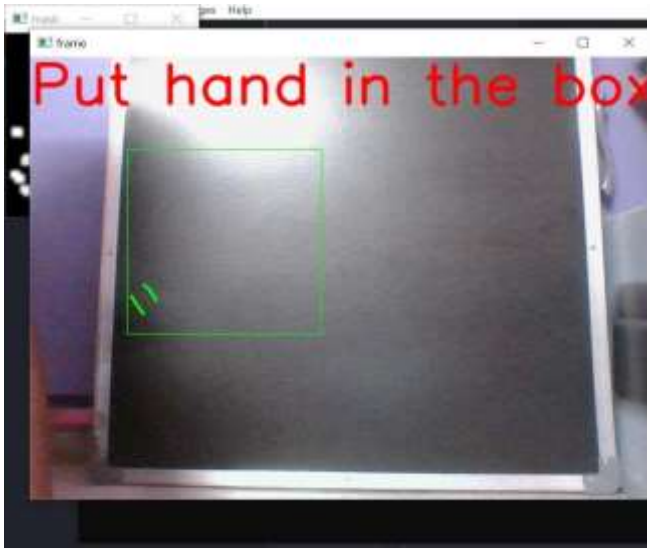
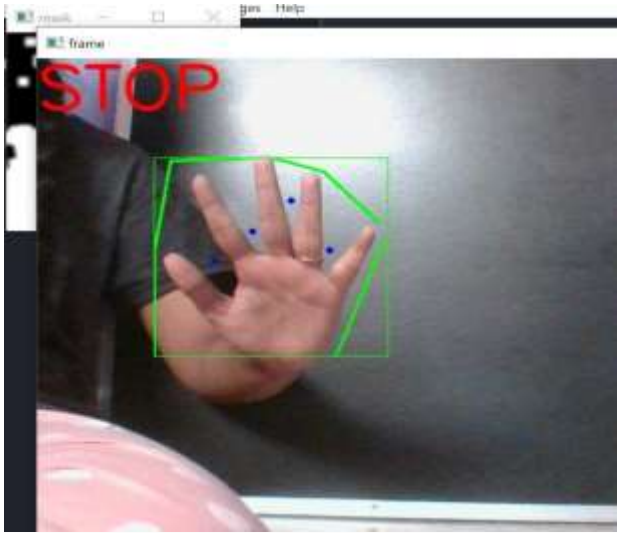


Fig: Comparison between grayscale image and threshold image

3.Track Gesture of Hand:
The Python programming language and the OpenCV package are used in this project to recognize hand gestures. The Python programming language generates basic and easy-to-understand system code. NumPy is also the Python module used here. The image acquired with a web camera will be processed in a region called Region of Interest (ROI), which will be active as a region of the desired area while the background is ignored.





4.Region of Interest:

The ROI, or Region of Interest, is a region that will be regarded as the desired area while ignoring the surrounding area, known as the background. According to Sander, the detected region must be in the same location as the region of interest in order to identify the availability of hand recognition. In other words, the area of the hand must coincide with the region of interest as the classifier tracks the desired object, in this case, the bounding rectangle around the hand contour. The system may determine whether the selected region, in this case, the rectangle around the hand contour, overlaps with another active region, in this case, the hand itself, using the conditional approach of the overlapping region.

The procedure of identifying the appearance of a hand will be greatly simplified compared to the other technique by applying this theoretical element of ROI to simulation and hardware implementation. The requirements for ROI overlap that can be termed overlapping ROIs are shown in Figure 2. These requirements must be met in order for the program to be able to detect hand motions**.**

Overlapping Region of Interest (ROI): For this project, the Region of Interest (ROI) is used to see the gesture of hand because the implementation for the ROI is suitable to detect the overlapping two regions on it. Besides, the system will detect only two outputs for each hand gesture recognition.

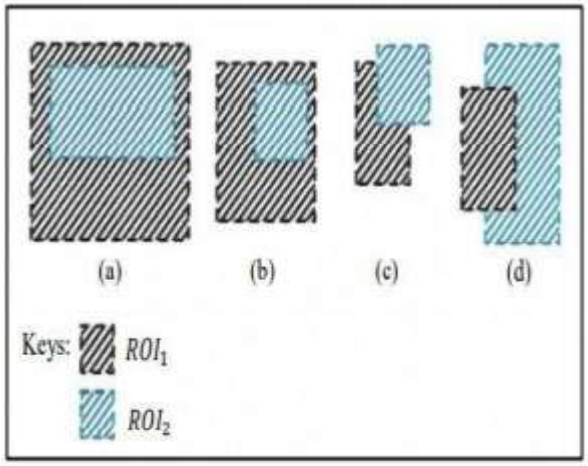


Fig: Implementation on simulation and Hardware Prototype

5.Implementation on Simulation and Hardware Prototype:

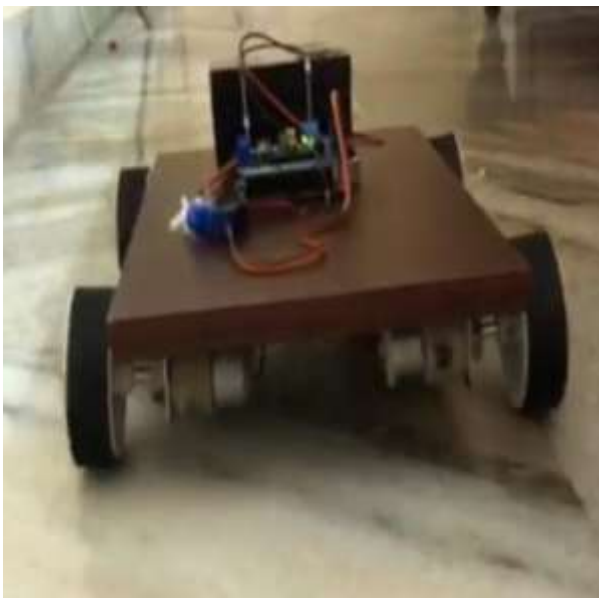


Fig: Four-wheeled Bot

The space consumption inside the area between the convex hull and the contour of the hand was estimated to detect hand motions. By constructing a descriptor in which the smallest convex set comprises the edges, the convex hull is used to find the edge of the user's hand.

The OpenCV library files are utilized in this project, which is usable for any image processing techniques.

Case 1: Run code when the bot is connected to Bluetooth.

This shows that the connection was successfully established, and so this test case will pass.

Case 2: Making gestures without creating a bot relationship.

In this case, only one module is working well, indicating that the model will not work properly.

Case 3: The bot is connected, but there are no motions.

In this circumstance, bot connections are established properly, but the bot will not move unless we make any gestures. It'll be in a laid-back mood. As a result, it is doomed to fail.

Case 4: When you make an unidentified motion.

In this scenario, the bot will not move because when we place our hand in the box, it tracks our motions and, depending on the number of contours that occur, the bot will accept the gesture and start moving. This test case, however, will fail if we make an erroneous motion.

6.Expermental Results and Discussions:

One of the methods that can recognize a hand motion in real-time video is hand gesture recognition. Hand gestures are categorized according to their subject matter. Designing hand gesture recognition is one of the difficult jobs in this study, involving two key issues. The first is the detection of a person's hand. Another issue is creating a sign that can only be utilized one hand at a time. This study focuses on how a computer vision system could detect, recognize, and interpret hand gesture recognition with problematic elements such as position, orientation, location, and scale. Different forms of gestures, such as numbers and sign languages, must be established in this system to function well in developing this project.

Before image processing, the image taken from the real-time video is evaluated using contours to detect the hand motion or, in other words, to detect the appearance of the hand in a frame. The detection of hands will be done in this project using the theories of Region of Interest (ROI) and Python programming. Because the source code to read the real-time input video is different for the hardware implementation, the description of the results will center on the simulation aspect. The theories of hand segmentation and the hand detection system can be applied to the construction of hand gesture recognition utilizing Python and OpenCV.

Anyone, from anywhere in the globe, can control these four-wheeled robots. Through a webcam, it provides a live feed to our device. Even deaf and dumb people can use this robot to transport items from one person to another because it accepts input through gestures.

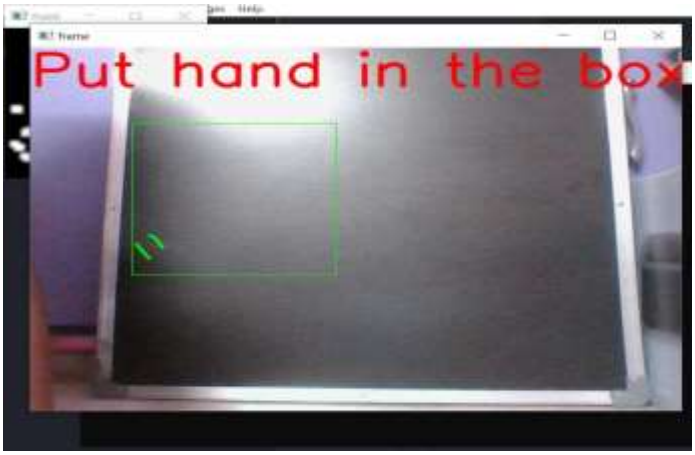


Fig 6a: Graphical User Interface (GUI)

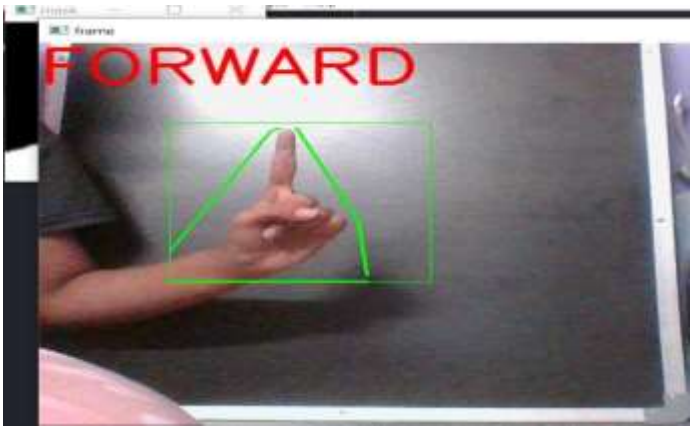


Fig 6b: Graphical User Interface (GUI)

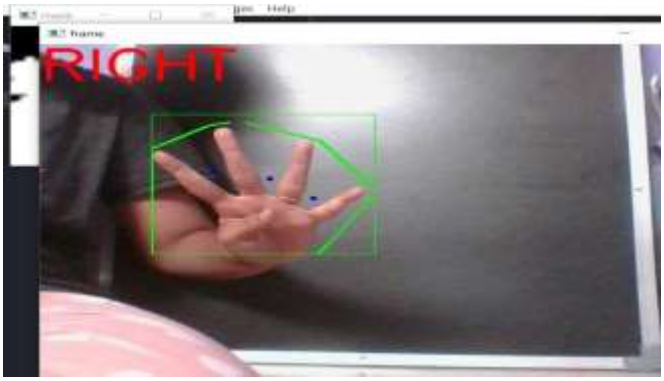


Fig 6c: Graphical User Interface (GUI)

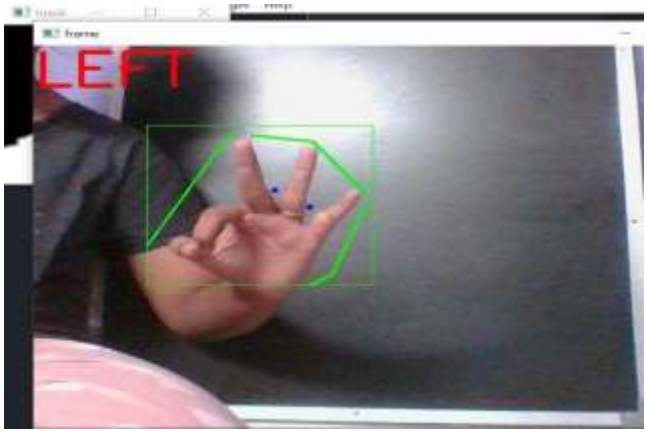


Fig 6d: Graphical User Interface (GUI)

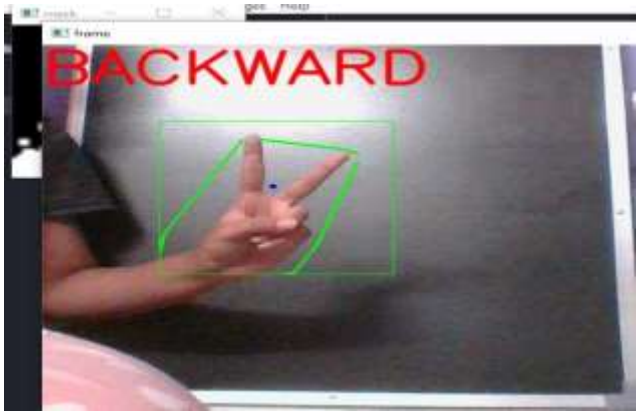


Fig 6e: Graphical User Interface (GUI)

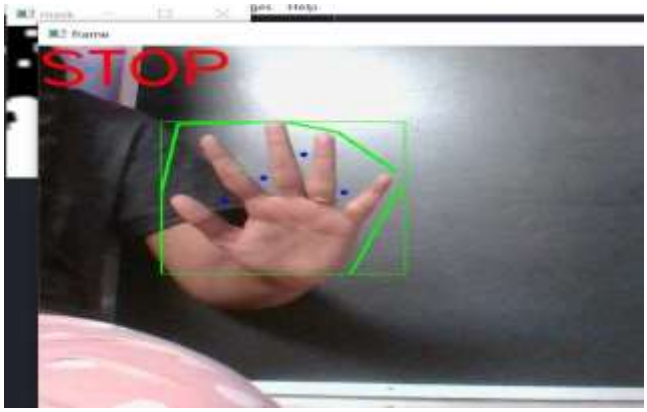


Fig 6f: Graphical User Interface (GUI)

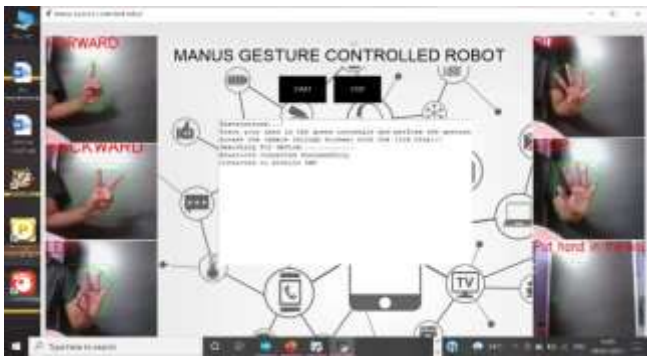


Fig 6g: User Interface

6.1.1 Live stream from Camera Web Server

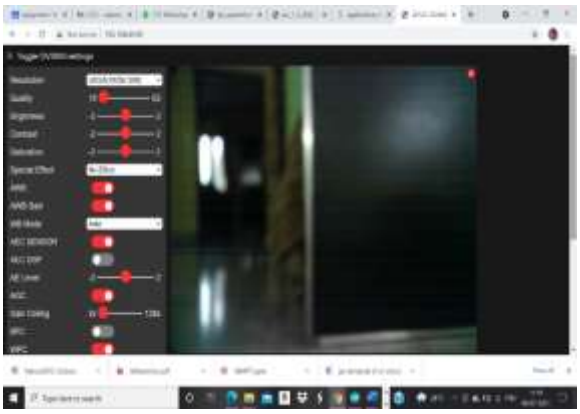


Fig 6.1.1 Live stream from Camera Web Server

Conclusion:

A system for contactless HCI with a hand gesture was presented in this paper. The Arduino-based wireless control system, as well as the ESP32 camera module, has been developed and tested. The experiment yielded good results, indicating that the ASL fingerspelling may be detected in a variety of settings. Furthermore, according to the RFA, this technique does not require any data training, making it quick and simple to use. The bot will move in response to the motions, and our idea may be utilized in this COVID-19 scenario to provide medicines, food, and other necessities to patients without requiring any physical touch. As a result, the infection is less likely to spread.

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