

Smart Bed based on Convex Hull Technique

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Abstract—Covid 19 is an emerging, rapidly evolving situation. As the number of COVID-19 cases increases across the world, the front-line healthcare workers who are at the forefront of the battle against coronavirus are now at the receiving end. Reports on doctors and nursing professionals getting infected with COVID-19 has taken up a permanent spot among the daily news. The spike in infection rate among medical professionals can be attributed to several factors. The social distancing & most safety measures have intensified the duty of every frontline worker. Such a time has called out for an advanced step to be taken in the essential works of any Medical Unit. A novel idea to reduce the requirement of healthcare workers and to enhance the patient comfort level. We have proposed a contactless fully automatic hand gesture control multi usable bed for disabled covid patients. A particular gesture input is given by the patient to the system, then given to the micro controller. The Arduino micro controller takes the gesture as input and generate some output that are passed to the servomotor. Here three servo motors are used to move the bed clock wise and anticlockwise depending upon the gesture given by the patient

Keyword: Covid 19; Healthcare Workers; Pandemic; Bed Model, Servo Motor; Thresholding; Convex Hull; Hand Gesture Recognition; Micro-controller; Arduino.

I. INTRODUCTION

The coronavirus disease-2019 (COVID-19) pandemic is an ongoing destructive threat to public health and livelihoods around the world. Front-line healthcare workers (HCW) are medical professionals who play a vital role in providing care to infected persons. Many health care workers have been invaded with the covid-19 and have lost their lives worldwide during the pandemic. Coronavirus (COVID-19) was first recognized in City in Hubei Province and other parts of China. After inflicting great morbidity and mortality in China, by February 2020, COVID-19 had spread to numerous other countries. As of May 18 2021, COVID-19 has unfolded to 203 countries, infecting 185 million people and inflicting 3.8 million deaths the world over and is consequently taken into consideration an international pandemic

Healthcare workers are more liable to COVID-19 infection than the general populace because of frequent contact with infected patients. At the least 18,500 medical professionals have died worldwide over the last year. Therefore, in this case need to find powerful ways to maintain them secure additionally assist them keep social distancing have emerge as a need.

The electronic bed systems available in hospitals are specifically designed for disabled sufferers and others in need of special health offerings. These electronic beds are designed with special functions, which might be secure to the affected person and additionally handy to the health care workers. Therefore, the requirement of caretakers for converting the placement of the sufferers if they want to move to their right or left facet. So, to decrease the requirement of caretakers and to boom the affected person consolation stage here two greater movement are brought to the present bed system

II. LITERATURE SURVEY

The literature survey performed affords an insight into the specific techniques that can be followed and implemented to obtain hand gesture recognition. It also facilitates in expertise the benefits and disadvantages associated with the numerous strategies. Hand Posture Recognition using K-NN [1] is a real time vision-based hand posture recognition approach. K-NN and SVM classifiers with different configurations have been employed to test and evaluate the method, But the system needs dark color background for hand gesture recognition. Bed Exit prediction applying neural network system [2] uses a monocular camera and detect a patient sitting on bed edge. Falls in hospitals are recognized to be related to extreme accidents. Detecting the side sitting role, that is a preliminary motion while a patient liable to falling leaves the bed, contributes to decreasing the danger of falls in a patient who needs assistance but is strolling alone. In 3-D Hand Gesture recognition [3], a skeleton-primarily based technique is proposed for 3-d hand gesture recognition. This technique could be very long and the primary undertaking is the net popularity of three-D hand gestures. Glove used Hand gesture recognition become accomplished with wearable sensors connected at once to the hand with gloves.

The records amassed had been then processed the usage of a laptop linked to the glove with cord. This device of glove-primarily based sensor may be made portable by way of using a sensor attached to a microcontroller. Hand gestures for human-computer interplay (HCI) started out with the discovery of the statistics glove sensor. It provided simple commands for a laptop interface. The gloves used distinct sensor kinds to seize hand movement and role via detecting the proper coordinates of place of the palm and hands. Even though the techniques stated above have furnished proper outcomes, they have got numerous barriers that make them mistaken for the aged, who may additionally experience discomfort and confusion because of twine connection issues.

III . SMART BED BASED ON HUMAN HAND GESTURE

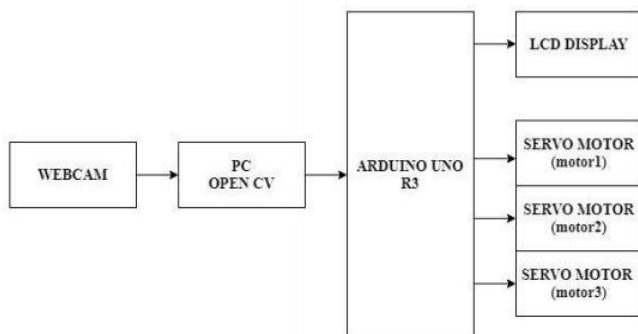


Fig.1.1 Block diagram for Smart Bed

The smart bed is a contactless fully automatic hand gesture control multi usable bed. It is mainly designed for bed ridden covid patients. In this bed system there are total five movements of the bed that is front, back, right, left and normal can be achieved. The camera is used to capture or record the different gestures of the person as per their requirements. In order to recognize the hand gesture recognition using the convex hull technique, the accurate preprocessing operations are performed on current images. The different gestures recognized are sent to the microcontroller. Here the Arduino micro controller takes the gesture as input and generate some output that are passed to the servomotor. These recognized gestures are further used to change the position of the bed model as per the patient requires. Three servo motors can be used to control the position of the bed. Movement of one motor in required angle can be used for upward and downward position control. Similarly, the movement of second motor can be used for left and normal position control. Then the third servo motor attached to the bottom of bed controlled right position. A LCD (16 × 2) display is also be used in the proposed hardware to display the bed position.

IV. HAND GESTURE RECOGNITION BY CONVEX DETECTION

In issues concerning human arms inclusive of signal language reputation and gesture popularity, fingertip is one of the maximum popular traits because the wide variety of fingertips may be taken into consideration to be the wide variety of arms and the path of fingertips can successfully explicit the stretch information of fingers. issues involving human hands such as sign language recognition and gesture recognition, fingertip is one of the most popular characteristics because the number of fingertip Contour analysis is a commonly used method for fingertip detection, which achieves the location of fingertip based on geometric features of contour, such as the edge curvature method used in literature for contour detection, and the least square ellipse fitting method used in for fingertip detection, this kind of algorithms require high accuracy of contour and a large amount of computation, and are very dependent on the quality of gesture segmentation. In this paper, a method of fingertip detection based on convex defect is adopted. For the first, we would explain some concepts of convex defect.

1) Contour

The contour of hand is a series of points which are the boundary pixels of the hand area. After obtaining the contour, the gesture and its shape then can be detected and recognized by using contours analysis.

2) Convex hull

The convex hull of hand gesture contour is the convex polygon surrounded by all the convex vertices in gesture contour.

3) Convex defect

The convex defect is defined as the difference between gesture convex hull and contour, they are contained in the convex hull but not hand area. The data structure of each of the convex defects contains three components: start contour point, end contour point and concave contour point.

V. FLOWCHART

The first task is to detect hand in the video frame. Firstly, the image is captured using the webcam and the captured image is segmented. After the hand is segmented, the number of fingers raised is detected. For this the largest contour is found. Then, we will find the convex hull and convexity defects which are most probably the space between fingers. With segmentation we refer to the process of extracting objects of interest from an image Segmentation technique based on thresholding grayscale images is used here. This technique is generally fast and reliable (with the right images).

The captured picture from webcam is first resized after which transformed to grey scale as shown in fig 1.2. RGB to gray conversion is used. This processed image is then binarized the use of thresholding strategies. Here binary inverted threshold is used.

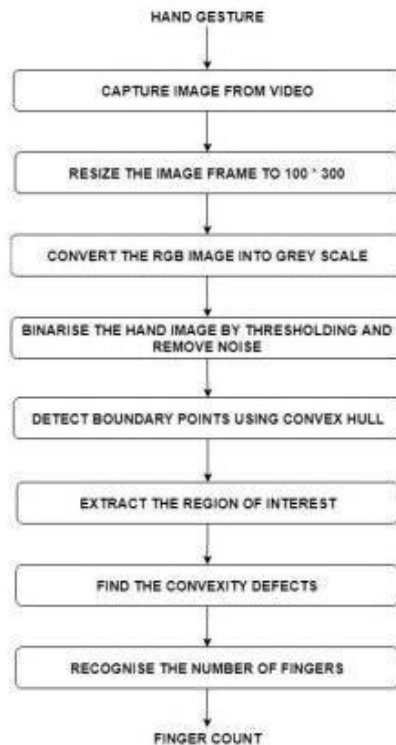


Fig 1.2 Flow chart for Finger count

In this if the image pixels are greater than the threshold value then it is converted to 0 (black) and values lesser than threshold are converted to a maximum value (white). This image is then smoothed to dispose of noise. Therefore, we can hit upon the hand from the video frame. Now with the aid of the usage of the manual method, we will start to find the biggest contour which is assumed to be the hand. After locating the biggest contour, we are able to find its convex hull. The convex hull is actually a curve overlaying the contour. From the convex hull, we can find the convexity defects. The output can be the quantity of convexity defects, if the range of convexity defects is two, then the variety of fingers raised is three. The second and third part of the device is to trade the smart bed position by hand gesture while rotating the servomotor. Here the three servomotors are directly related to the Arduino board. The primary servomotor is hooked up to the D9 pin of the microcontroller, the second one motor to D10 and the third motor to D11. Once the finger be counted is detected it is made to be had on the D4 to D8 pins of the micro controller. The Arduino instructs the servomotor to take essential action. Primarily based on which pin receives excessive cost, these are assumed to be the spaces between the fingers. We will use this to determine the number of fingers. The output will be the number of

convexity defects. For example, if the number of convexity defects is two, then the number of fingers raised is three. The second part of the system is to change the bed position by rotating the servomotor. Servomotor can control the position of objects with high precision. Here the three servomotors are directly connected to the Arduino board. The first servomotor is connected to the D9 pin of the Microcontroller, the second motor to D10 and the third motor to D11. Once the program is started, all the three servomotors are at 0 degree. Now using microcontroller, we can tell the servo to rotate to the required position. Once the finger count is detected it is made available at the D4 to D8 pins of the Arduino board. Based on which pin gets high value, the Arduino instructs the servomotor to take necessary action.

VI CONCLUSION

As the world is fighting the Covid-19 crisis, Doctors and healthcare workers are working day and night to minimize the damage due to the pandemic with constant checks on the patients. The threat of them catching the coronavirus and infecting their own families also looms large. Therefore, in this situation the need to find effective ways to keep them safe also help them maintain social distancing have become a necessity. A novel idea to minimize the requirement of caretakers and to increase the patient comfort level. SMART bed is designed to control the position of the bed automatically by using handgesture recognition. Prevent Intra-Hospital transmission of corona virus and resist spreading of Covid -19 virus among health workers.

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