The Performance of Eyes and Hand Gesture Translation to Control Body Turn for Paralyzed Patients

Pimpisa Chankumsri Waranee Chokanunt, and Nunnapad Toadithep

***Abstract*-This research aims to use the technology of image processing for assisting the Paralyzed Patients to change their posture on bed: turn left, turn right and at the center. Using the patient's organ that do not paralyzed: fingers and eyes. The picture of actions is captured from web camera, if detect the starting sign, the processes of interpreting the meaning of fingers or eyes are performed. The main principle of fingers detection is, take the input image and subtract from background image, and using the contour algorithm for counting the number of fingers: one, two, and three. In the case of interpreting from the action from eyes, firstly must detect face of patients, using Haar-Like features, and then using Hough Transform for detecting the eye-pupil and interpreting the result. On testing cases of 5 persons, 10 times action for each. We found that, the percentage of accuracy of hand actions is 95.33, the percentage of accuracy of eyes actions is 94.67.**

***Index Terms*—Haar-like feature, finger, eyes, paralyzed patients, body turn.**

I. Introduction

Nowadays, Computer Technology plays an important role in everyday lives of Human. Not except the paralyzed patients, who unable to help themselves, need carefully take care from nurses or the attendants. These make difficult and laborious works to surrounding people. Not only, but also this event causes problem to the paralyzed patients themselves. They must stay on bed steadily for a long time and cannot communicate with other easily. These features of patients cause the pressure ulcers and infection in the urinary tract. For many obstacles with relative people and the patients themselves, and for helping the patients body turning by themselves, do not depend on others. We are very please to make a research in this medical field, with the assisting of image processing technology, the paralyzed people can use their fingers and eyes for indicating the desires of turning left, turning right or staying at center. This work use OpenCV for implementing the procedures.

II. Related Theories

A. Face Detection with Haar-Like Features

Haar-like feature [7] is the detection strategy and the object interpretation by making square feature to show different results between white and black parts. The square is changeable, it can change size and positions.

It detects figures in the picture such as straight line and circle. Haar-like simulation types has 14 limited cases as the following figures. Fig. 1 shows features detection squares types

1) Edge capability
2) Line capability
3) Center capability
4) No use

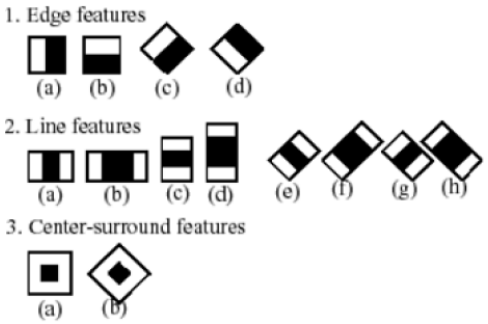

Fig. 1. Features of Haar-like detection.

B. OpenCV (Open Source Computer Vision Library)[4]

OpenCv is a library for image processing and computer vision. The capability of OpenCV is blurring image threshold detection, Histogram detection. However, the main capability is frame detection, movement detection and image segment- ation.

Moreover OpenCV is able to manage video data because OpenCV is not a commanding program set. When it is needed to be used, the program will be written to command, usually language is C, C++ , and Python. OpenCV consists of 2 parts, first, data structure that store data such as images, matrix, and coordinate. Second, algorithm, it processes data especially image data. In addition OpenCV consists of 4 libraries:

Fig 2. Shows the relationship of 4 component parts of OpenCV.

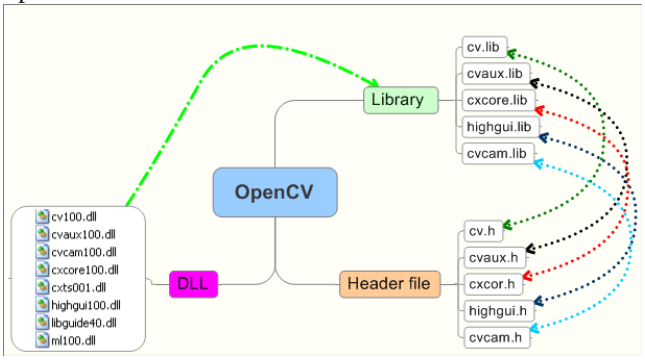

Fig. 2. The relationship of openCv library, DLL, and header file.

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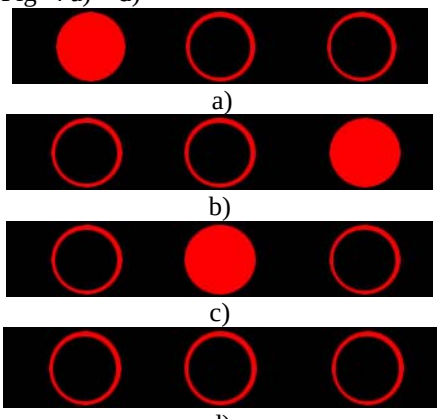
1) CXCORE : is a primary function manages spot, size , array, and memory store, drawing command, image variable informing, example of image declaration such as IplImage, Cvmat, CvMatND.
2) CV : is used to process and analyse image. The function mostly work with a dimension array image spot or the other words that is called angle or edge detection and histogram creating.
3) Machine learning : is a library that gathers classes, statistical functions and clustering classification functions.
4) HighGUI : is a library to pull out image, recording, VDO connection, window/frame making for show and break image. Window/frame transition, including mouse and keyboard verification .

III. System Architectures

This system comprise of 2 main functions, first interpretation hand gesture, second interpretation eyes gesture. Fig 3. is the first page user interface of system, user can choose to use hand or eyes.

Fig.3. The page of user interface of system.

There are 4 states output of the interpretation for further action of body turning, left , right, center and unchanged as shown in Fig 4 a) – d)



a)
b)
c)
d)

Fig. 4. The output of interpretation.

A. Fingers Interpretation

Fig 5 shows flowchart of fingers interpretation. Fig 6- Fig 9 show the output from mainly steps of procedure.

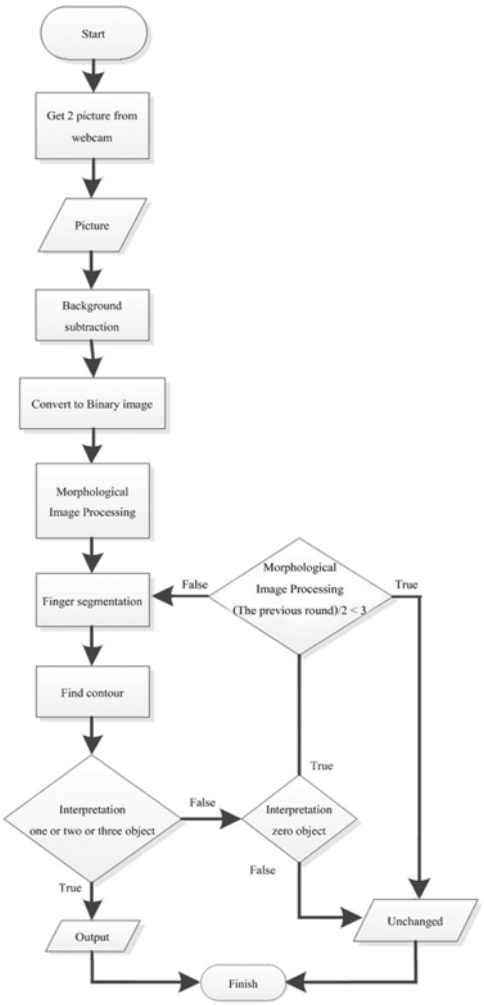
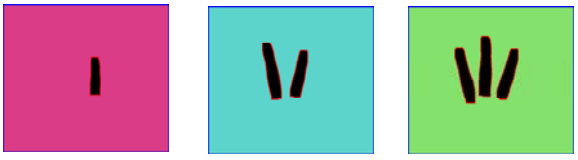


Fig. 5. Processing flow of fingers detecting and counting.

Fig. 6. The starting sign of process.

Fig. 7. The action of patient's desire as an input.

Fig. 8. The result of finger dectecting after subtract from background.



a) one finger b) two fingers c) three fingers

Fig. 9. The result of finger counting by contouring the objects.

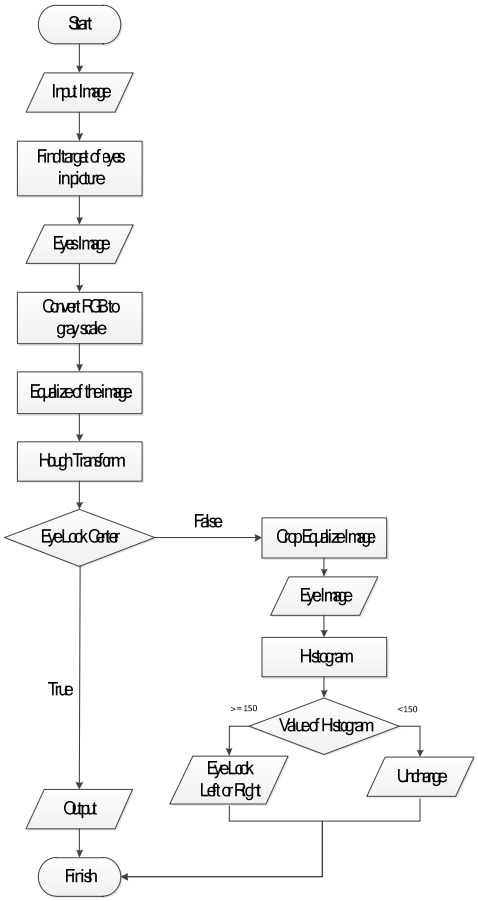


Fig. 10. Processing flow of eyes interpretation.

B. *Eyes Interpretation*

Fig 10 is the flowchart of eyes interpretation. Fig 11- Fig 13 are the mainly steps of procedure. The significant process of eyes sign interpretation is equalization of image before eyes detection, if do not doing this process, we got the 100 percent incorrectness.

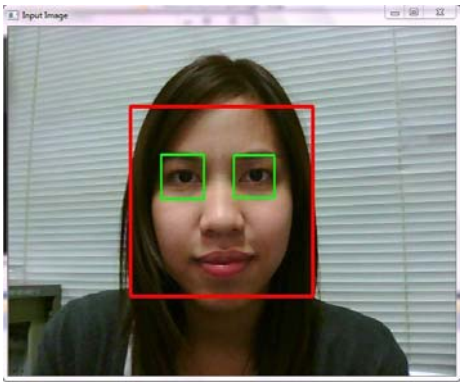


Fig. 11. Face and eyes detection.

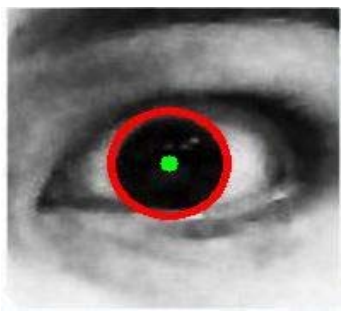


Fig. 12. Eye-pupil at center.

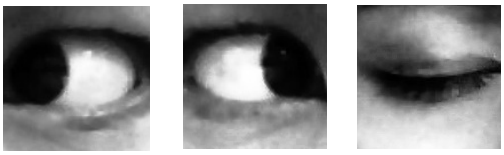


Fig. 13. Eye-pupil at left, right and close eye.

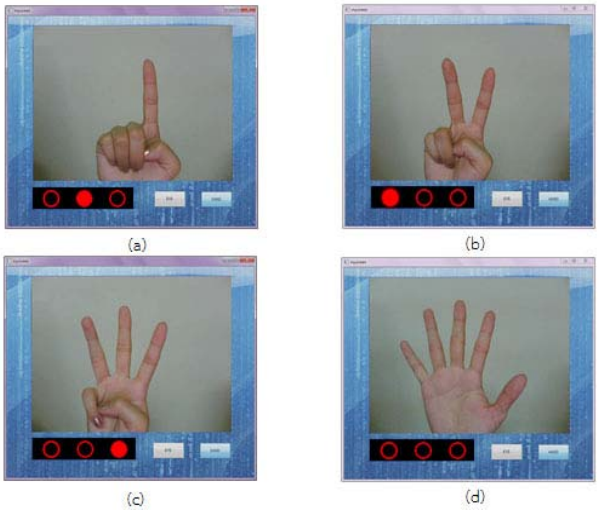


Fig. 14. Sample test cases of hand.

Fig. 15. Sample test cases of eyes.

IV. Conclusion

The action from Paralyzed Patients using the sign of action gestures of fingers and eyes. The number of fingers: one finger means staying at center, two fingers means turning left, and three fingers means turning right. Fig 14 shows the hand gesture and the result of its interpretation. Fig. 15 shows the eye look and the result of its interpretation. The result of fingers interpretation gets 95.33 percent of accuracy. The result of eyes interpretation gets 94.67 percent of accuracy. In the real scenery, the patients have a chance to choose the organ use. Testing the system of each organ use, 50 times of 5 persons of 10 actions each. The result of experiment are shown in Table I., and Table II.

TABLE I: The Result of Hand Gestures

Hand	#right	#wrong	total
One finger	49	1	50
Two fingers	47	3	50
Three fingers	47	3	50
Average (%)	95.33	4.67	100

TABLE II: THE RESULT OF EYES GESTURES

Eyes	#right	#wrong	total
Straight	45	5	50
Left	50	0	50
Right	47	3	50
Average (%)	94.67	5.33	100

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