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Head Gesture Recognition System using Thermal Camera

Rushikesh Bankar, Suresh Salankar

Abstract*: The Gesture is defined as movement of the part of the body. In the existing research work, the research based on the camshift based head gesture recognition system is going on. This existing system deals with some limitations. So, to overcome these limitations, the methodology used in this paper is to improve the existing algorithm and the camera used. This proposed system is used in an intelligent wheelchair for the peoples having parkingson and quadriplegics diseases. The HGR System is the difficult task in the field of image processing. The different researchers applied different algorithms for identifying head gestures in the outdoor environments. In this paper, head gestures of the user are recognized by using thermal camera. The different environmental conditions are the cluttered background, sunshine, shadow, changing illuminations, lighting condition, darkness conditions etc. the role of thermal camera is the best in the darkness conditions. The simulation results shows the use of thermal camera in the darkness conditions.

***Keywords*: Thermal Camera, Darkness conditions, Head Gestures, Head Movements, and BLBP.**

I. INTRODUCTION

The handicapped people or the people having paralysis from nake side to the below side of the people or the people having diseases such as parkingson, quadriplegics etc. uses the HGR System. Moreover, HGR System is used in the medical application like an intelligent wheelchair. The existing researcher applies different algorithms in an intelligent wheelchair. HGR system follows the three steps. The first step is detection of the face of user. Face detection is most biometrics authentication technique from the last few years. In this, the viola jones method is used. The face recognition [1] is the process of using the face properties in the biometric systems. The face recognition of the user uses verification step as well as identification step. In the identification step, the comparing of the query face image of user with face images of user against all image templates in a face database of the user. The second step is face tracking of user under different environmental conditions. Andres *et. al.* [2] presented method for tracking face of user in cluttered background.

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***** Correspondence Author
Rushikesh Bankar*, Department of Electronics Engineering, G H Raisoni College of Engineering, Nagpur, India.
Dr. Suresh Salankar, Department of Electronics & Telecommunication Engineering, G H Raisoni College of Engineering, Nagpur, India.

The system explained is based on the process of subtraction of successive frames as well as the regions of interest.

The third and the last step is recognition of head gestures of user. There are different methods in which the head gestures of the users are recognized. These methods are (i) HGR using lip detection method (ii) HGR using conk prototype corresponding method and (iii) head gesture recognition using different sensors. In the paper [3], the author presented HGR System using nose template matching method. In this system, the five frontal face gestures of the user are recognized which are namely; frontal center; front up side; front down side; front left side; as well as front right side. Each head gestures of the user has two output images. They are; the detected face and the recognized head gesture.

II. PROPOSED METHODOLOGY

The proposed methodology of this paper includes the block diagram of the proposed system, algorithm used for the system, and finally the flow chart of the proposed system.

The adaboost algorithm is used for the detection of the face of user. Using camshift algorithm, we tracked the face of the user. Finally, using nose template matching method, we recognized head gestures of the user in different movements.

A. Block Diagram

The below figure shows flow chart for head gesture recognition system. From above flow chart, we use thermal camera to recognize the head gesture in the darkness condition. In the darkness conditions, the normal camera cannot work properly. The head gesture recognition system includes detection, face tracking and gesture recognition which is known as head gesture based interface. For face detection of the user, adaboost algorithm is used. The adaboost algorithm is the most recent face detection method. The adaboost algorithm has both high accuracy as well as fast speed. The adaboost algorithm extracts the haar-like features of the image. Then done tracking using camshift algorithm. Finally using nose template matching method, head gestures of the user are recognized. For face tracking of the user, camshift algorithm is used. The camshift algorithm is a very efficient color tracking method. The camshift algorithm is a classical optimization algorithm. The camshift algorithm is a fast object tracking method and is based on the image hue. The camshift algorithm uses a robust non-parametric technique.

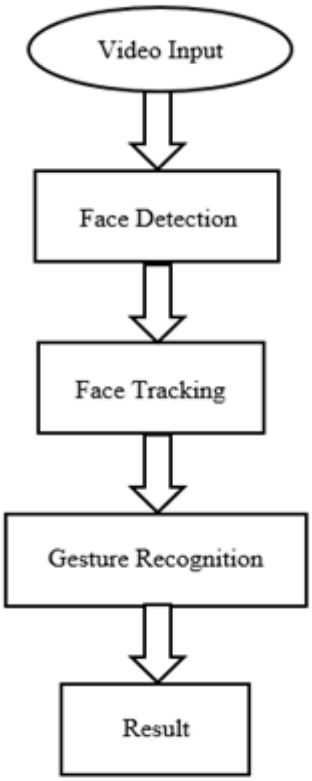

Fig. 1. Flow Chart for HGR

B. Methods Used

The methodology used in this proposed system is to use adaboost algorithm for the face detection, improved camshift that is the camshift with BLBP, and finally eye template matching method to recognize the gestures generated by the user's head. Working of adaboost method is as given, when it is applied to the image then the bounding box is obtained over the face. That bounding box has four parameters which is x, y, width, and height. The x and y denotes the position. When the face is detected a small rectangle is inserted on the face part. After that the first frame is obtained. That first frame is called as the reference frame. It is one of the most accurate algorithm used for the detection purpose. The detection rate of the adaboost algorithm is very high. It takes the less time for the detection.

C. Flow Chart

The figure 2 below shows the flow chart of head gesture recognition system.

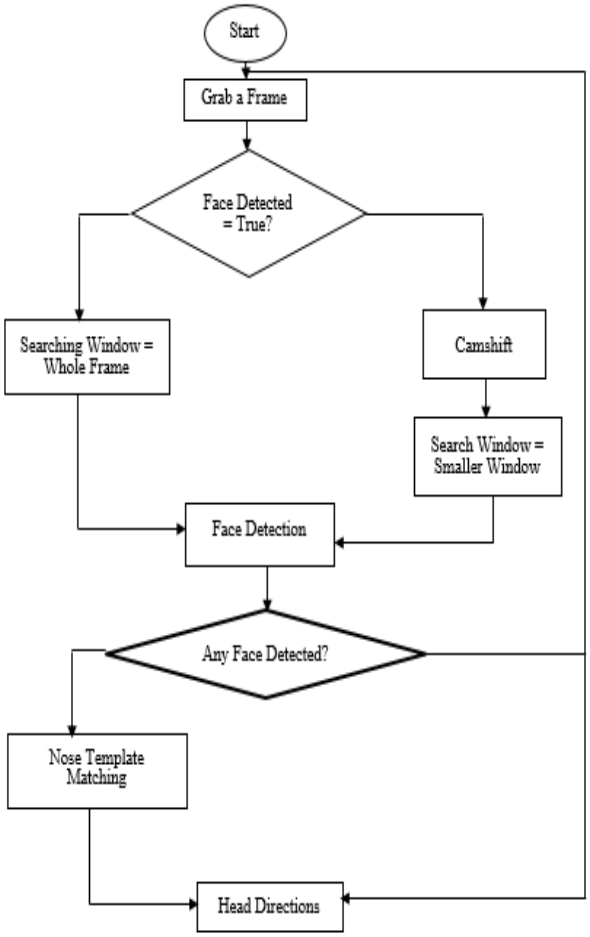

Fig. 2. Flow Chart of HGR System

In the flow chart of head gesture recognition system, first we grab frame from input video. In the frame of input video, we detect the face of the user. We search the window in whole frame of the input video of the user. Then applying the camshift algorithm to track the face of the user. After detecting and tracking of the face of user, we need to recognize head gestures of user. For that nose template matching method is used.

III. SIMULATION RESULTS

Figure 3 below shows the face detection, the 4 shows tracking, the 5 below represents tracking using improved algorithm. Figure 6 shows head gesture recognition using thermal camera.

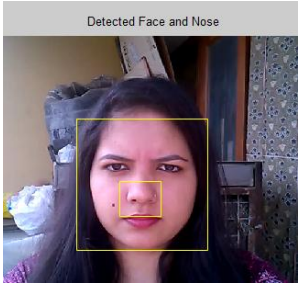

Fig. 3. Face Detection

Fig. 4. Face Tracking

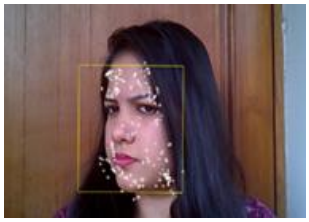

Fig. 5. Face Tracking using Improved Algorithm

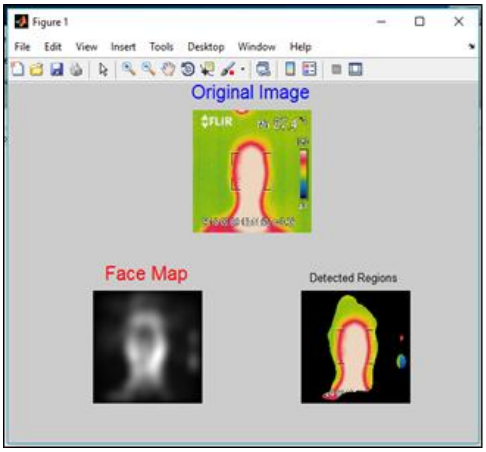

Fig. 6. Head Gesture Recognition using Thermal Camera

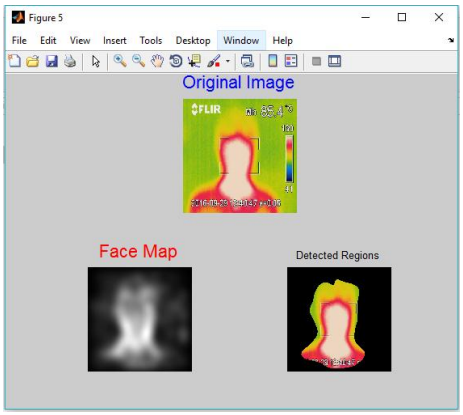

Fig. 7. Head Gesture Recognition

The adaboost method is used for face detection. The tracking of face of user is done by using camshift method. Camshift is a fast face tracking method. But the camshift has some limitations. That is the camshift cannot track accurately the face of user under changing illumination conditions. Also camshift cannot track face under the cluttered background.

IV. CONCLUSION

This paper describes face tracking of user in darkness. Also the face tracking of the user in cluttered background, sunshine and shadow environments. The existing HGR System cannot tracks face of user in these environments. For identifying gestures of user in darkness, Thermal Camera is very useful. So, this proposed system overcomes the limitations of existing HGR Systems. The future scope is implementation of system in intelligent wheelchair. Also, environments consider is indoor as well as outdoor for intelligent wheelchair.

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AUTHORS PROFILE

Rushikesh Bankar Ph. D. Scholar, Department of Electronics Engineering, G H Raisoni College of Engineering, Nagpur. The total number of paper publications are twenty in the number. Out of that the Four Ph. D. Research Papers published in Web of Science, One in Springer Proceeding.

Dr. Suresh Salankar Professor, Department of Electronics & Telecommunication Engineering, G H Raisoni College of Engineering, Nagpur. Sir has Ph. D. in Electronics & Telecommunication Engineering from the SRTM University, Nanded, India in 2008.