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Invited Paper

The System of Indicator by Moving Face

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Abstract. The prevalence of the driver license for the disabled is low. To improve this problem, we developed a system for someone easily turning on the direction indicator by moving a driver's face from side to side. First, a camera is installed as a car's interior and a driver's image is recorded. This program recognizes a facial motion of the driver with Optical Flow in Open CV. As a result, the indicator is moving from side to side by driver's facial motion. This paper established the technique of recognizing a facial motion. This system can turn on the direction indicator easily for intuitive handling in any direction.

1. Introduction

Now a means of transportation in Japan has been thought of mainly as cars, bicycles, taxis, buses, trains and monorails. The age of anyone moving freely has come. On the other hand, to support for the disabled is not sufficient. For example, when they use the public transport, they may need any supports by a porter or their family, and the assist instrument may take a lot of space. Besides, when they want to move, in an inconvenient environment they probably need a car. However, it still has some problems. We mention to you about moving by car. Now the prevalence of their driver license for the disabled is only about 14% [1, 2]. This result shows that many people are unavailable for using a car. As one of the main reasons, we can understand a car itself is hard to use for the disabled. In that case, the purchase cost rises and they can't choose their favorite car. In addition, it is difficult to share the car among the members of the family. This paper paid attention to disabled in the fingers. It may be difficult for them to turn on the direction indicator while driving. In this case, they buy a car for people with a physical disability or they drive in an inconvenient state. There is the risk to lead to an accident without the mutual understanding between the cars by the winker. To buy a new car isn't realistic for the disabled whose disorder doesn't come from a congenital disease. There is the blinker by a face direction for bicycles developed for people having a disability in a finger, but it uses Kinect and it costs a lot [3].

The cheap system which started a blinker by a face direction with one camera has been developed to solve these problems as the first step in this study. Because this is attached to a normal car and anyone can operate it, we aim for the favorite car for everyone. Because physically unimpaired people can drive the car attached to this, their stress can be reduced when they get into a car with their family and their friends.

2. Organization of the Text

At first, we show a design of the system in Fig. 1. We make one button which is easy to push and change ON/OFF of the system. When the system begins to work pushing by a button, this system distinguishes if the face direction right or left from the first position and start a blinker in the direction.

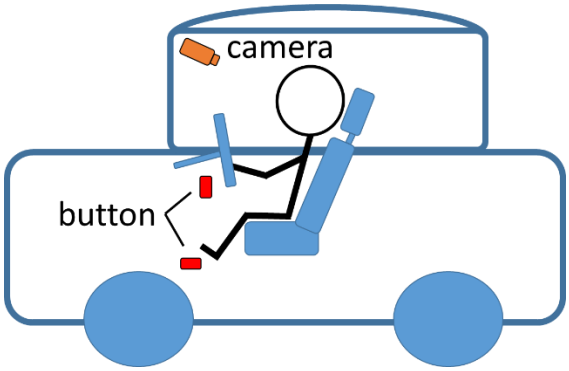

Fig. 1. Design of the system

In this article, Optical Flow of OpenCV is used to recognize the movement of the face. The necessary conditions are as follows: 1.The brightness does not change before and after the movement of the image. 2.The image is smooth. 3.The quantity of the movement between the images is very few. 4.The neighborhood pixel of the certain pixel moves in the same way. These conditions are necessary to know the face direction that the person in the image moved in that. Thus, the Lucas Kanade method is used for the reason of being suitable for an animation as well as an image [4]. In addition, the size of the image assumed 480*640 [pixel].

We explain the system in detail. At first, we look for the characteristic point of the first piece image. The characteristic point means that always exists and can be distinguished as a definitely different point from other characteristic points. We show this in Fig. 2. We calculate the vector of the characteristic point between the images, in search of the characteristic point of the second piece image. The position of the face is almost fixed in the car. We don't have to calculate the vector in the whole range of the image. We make it a condition that both the initial point, and the terminal point exist in the range. In the range, the top narrows down by 50 pixels, the bottom narrows up 140 pixels and the left and the right by 80 pixels. In addition, the too small vectors are noise and the too big vectors are misrecognition. So the suitable size of the vector assumed between 30 pixels and 200 pixels. Because it was not necessary. The angles of the vector must fit within +-20 degrees from right / left vector. Figure 3 presents these detail. When the angles of the vector is too big, this vector is recognized error. We show these conditions in Fig. 4. The program of the system calculates blue arrow in the white part of the figure, not the red arrow. The reason shows that the terminal in A vector is out of the range, an initial point in B vector is out of the range, and C vector is too small, and D vector is too big, and the angles of E vector is more than 20 degrees. It is F vector that meets all conditions in the Fig. 4. Ten left or right vectors that we detected under conditions of the above about the overall right and left distinction being more than it. In addition, at the time of number of other 1.5 times, we decide right and left, and it is necessary to turn to the front other than it.

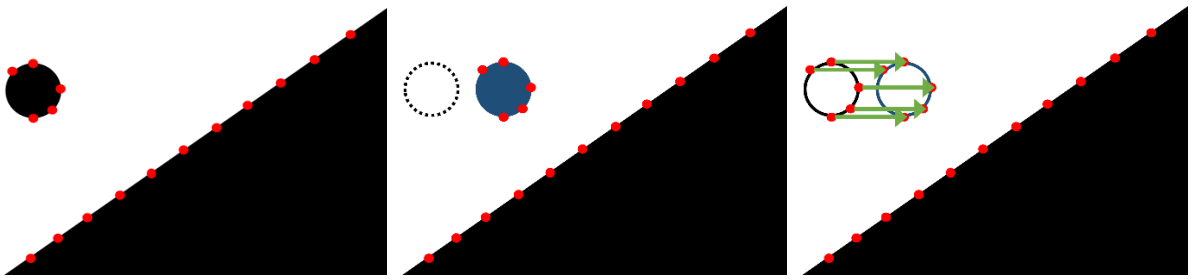

Fig. 2. Characteristic point

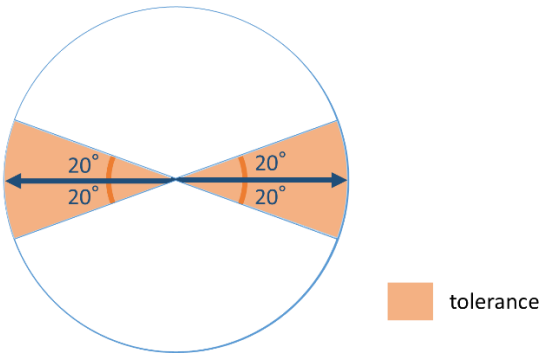

Fig. 3. The angles of the vector

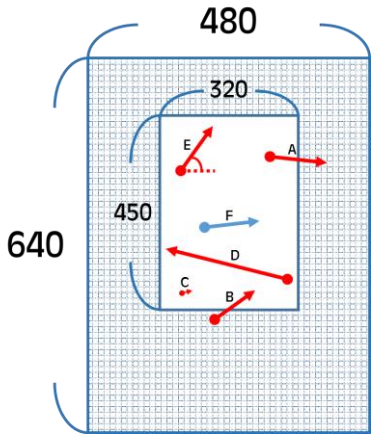

Fig. 4. Vector conditions

3. Experiment

In the experiment, the photographs of eight men and women which turn to the front, the right and the left are used. The photographs are filmed assumed by the distance between driver and camera. We show an example in Fig. 5. The vectors of turning to the right are shown in yellow, the vectors of turning to the left are shown in purple and the other vectors are shown in white. In addition, the result of the distinction is displayed on the upper left of the image.

By the system mentioned above, we were able to distinguish the face direction of all the members. In addition, this system was able to distinguish without a problem even if people wore a mask or glasses. This system able to distinguish in indoor, outdoor and dark place as shown in Fig. 5.

4. Conclusion

In this study, we suggested the system which controlled the indicator of the car by a face direction. As a result, this system was able to distinguish people's face directions. Even the people having a disability in a finger this system allows him or her to use the indicator by intuitive operation at their own free will.

However, we still have some problems. It is necessary to treat an animation not a still image in driving practically. In addition, it is really necessary to make something attachable to put on the indicator.

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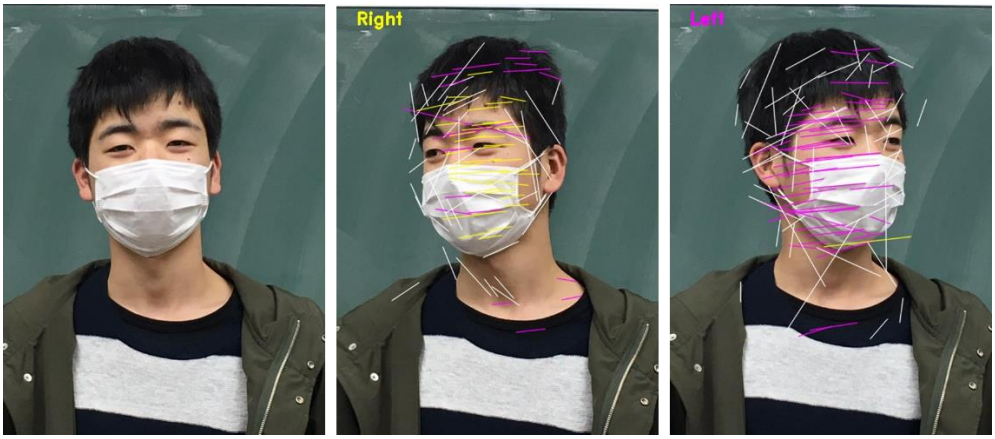
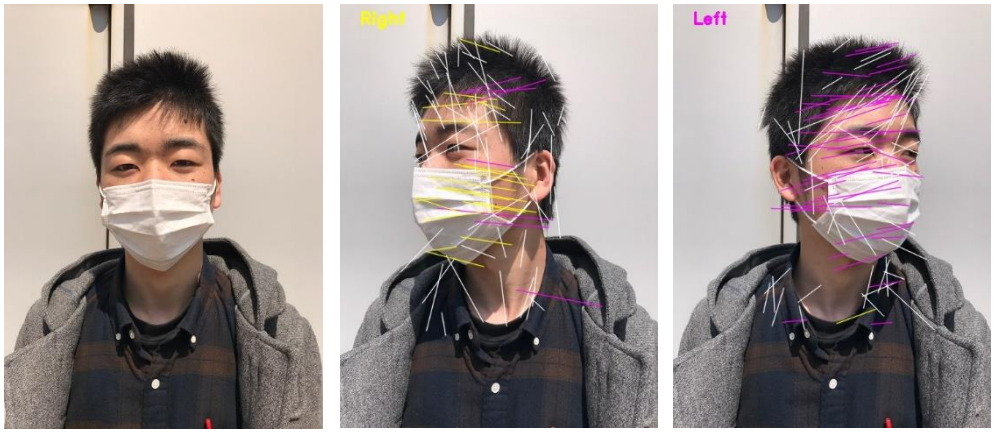
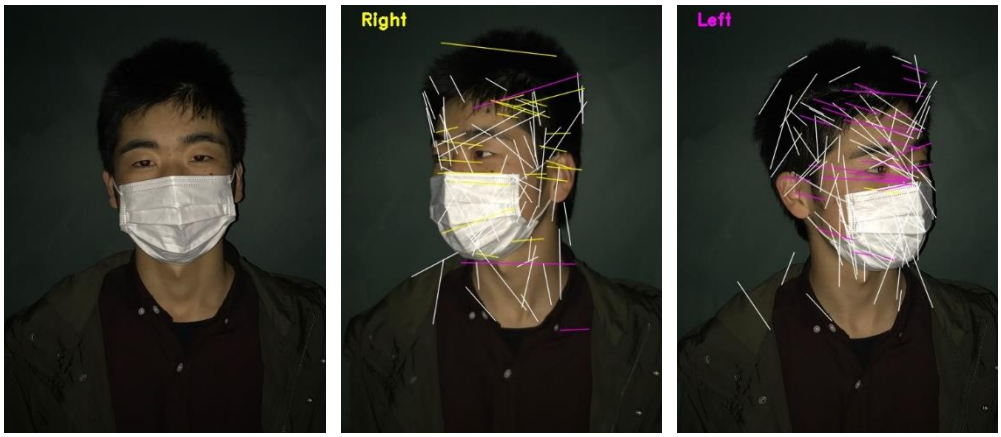


(a) Front (indoor) (b) Right (indoor) (c) Left (indoor)



(d)Front (outdoor) (e) Right (outdoor) (f) Left (outdoor)



(g)Front (dark place) (h) Right (dark place) (i) Left (dark place)

Fig. 5. Result