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A Review on Real Time Gesture Recognition in OpenCV

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Abstract— *As the use of variety of gestures specially made by the hands is one of the common and capable forms to articulate the intention of the signer. It also plays an important role of mediator for the natural or usual communication between the human and any electronic machine. Presently, the technique which has been used for the recognition of gestures created by the hands having great advancement and attains the good rate of recognition in various areas of analysis. But there are many issues, which is still needs to resolve in the technique. The issues are like: extraction of invariant features, transition model between gestures, automatic segmentation of recognition units, etc. In this paper, a review has been performed in the field of gesture recognition or gesture based operation using OpenCV.*

Keywords:— *Gesture, fingers, OpenCV, Contours, Camera.*

1. INTRODUCTION

There are so many systems have been proposed till now that are based on OpenCV libraries having capabilities of recognizing gesture with good level of accuracy. OpenCV (Open Source Computer Vision Library) which has been designed for advanced image processing. It has C++, Python, C and Java interface. Now a day's OpenCV is available with compiled libraries which do not require compiling again at the time of configuration.

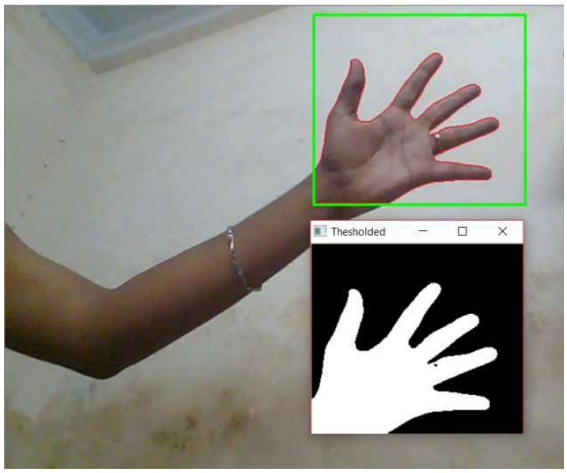

Figure 1. Hand Gesture Recognition

2. LITERATURE SURVEY

2.1 Review on existing systems:

Siddharth S. Rautaray, Anupam Agrawal, "Real Time Hand Gesture Recognition System for Dynamic Applications", IEEE Transaction, 2012. [1]

In this paper, a system which has been proposed is able to recognize particular gesture to perform action based on that gesture. This system uses OpenCV library and performing recognition by finding convex hull of the contour. They developed a virtual mouse based on gesture in which each gesture has different action such as two fingers up like victory gesture performs move up and three fingers up means move down. But this kind of virtualization is not user friendly because system requires plain background to recognize

gesture correctly and it does not work in noisy or non-plain background.

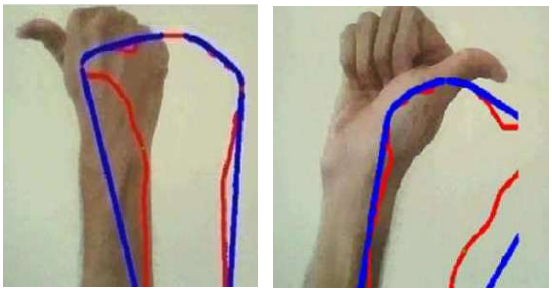

Figure 2. Move Left & Right Respectively

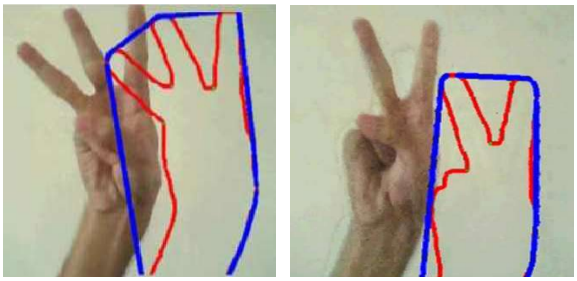

Figure 3. Move Left & Right Respectively

Zhi-hua Chen, Jung-Tae Kim, Jianning Liang, Jing Zhang, and Yu-Bo Yuan1, "Real-Time Hand Gesture Recognition Using Finger Segmentation", IEEE Transaction, 2014. [2]

The system which has been introduced in this paper is also based on OpenCV library by segmenting palm and fingers to recognize gesture. It means that system segmenting palm and finger separately through which gesture can be recognized through finger by wrist pointing and palm masking. But this system also requires plain background for segmentation and recognition; it does not work correctly in non-plain background.

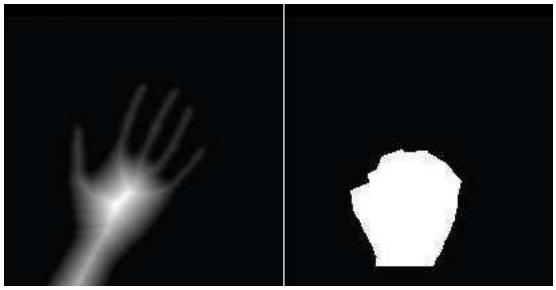

Figure 4. Palm & Finger Segmentation

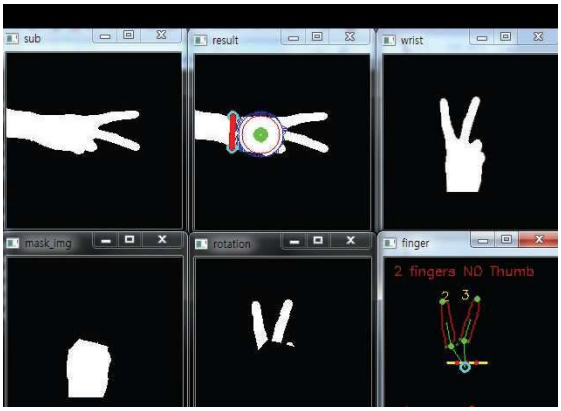

Figure. 5 Segmentation and Recognition

Atharva Ajit Kadethankar and Apurv Dilip Joshi, "Dynamic Hand Gesture Recognition Using Kinect", IEEE Transaction, 2017. [3]

The system which has been proposed in this paper is based Microsoft kinetic sensor that is a physical sensor through which hand gesture is separated and later match with directory to recognize input gesture. Microsoft kinetic sensor is using infrared to input data. System calculates centroid point in palm to determine the position of palm. The system is bit costly because of the sensor and uses hand geometry to recognize gesture which may have more error rate with less accuracy.

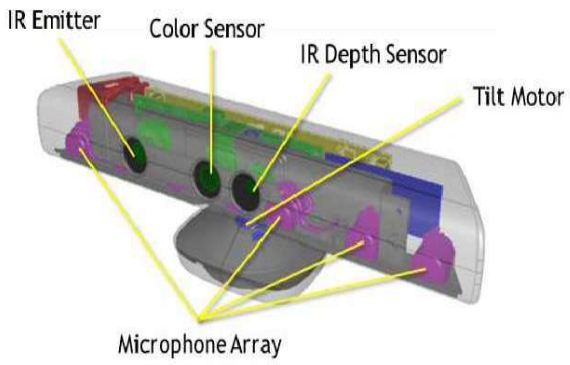

Figure 6. Kinetic Sensor

Marco E. Benalcázar, Cristhian Motoche, Jonathan A. Zea, Andrés G. Jaramillo, Carlos E. Anchundia, Patricio Zambrano, Marco Segura, Freddy Benalcázar Palacios and María Pérez, "Real-Time Hand Gesture Recognition Using the Myo Armband and Muscle Activity Detection", IEEE Transaction, 2017. [4]

This system is based on MYO Armband which can analyze or recognize muscle activity and on the basis of that gesture has been recognized. MYO Armband is costly and certain gestures can recognize only. There is a muscle movement or muscle stretches while putting a particular gesture and MYO Armband can recognize that gesture and can perform action accordingly.

Figure 7. MYO Armband

Andr´es G. Jaramillo and Marco E. Benalc´azar, "Real-Time Hand Gesture Recognition With EMG Using Machine Learning", IEEE Transaction, 2017. [4]

The system which has been proposed in this paper is also based on MYO Armband which uses electromyography and machine learning technique.

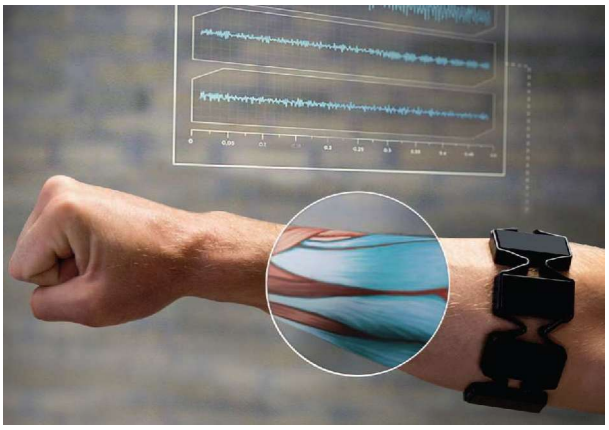

Figure 8. MYO Armband

Here, MYO Armband uses Bluetooth technology for transmitting data to the computer. It has eight sensors which can recognize electrical activities of the muscles. But the problem is that it has limited number of gestures that can be recognized through muscle activity. This system is also not cost effective because of MYO Armband.

Peijun Bao, Ana I. Maqueda, Carlos R. del-Blanco, and Narciso García, "Tiny Hand Gesture Recognition without Localization via a Deep Convolutional Network", IEEE Transaction, 2017. [5]

The system which has been proposed in this paper is based on convolutional neural network where hand segmentation is not prefered, instead of that a network has been trained which is able to recognize hand gesture. But this system is not very much effective in complex background, it works well with plain background.

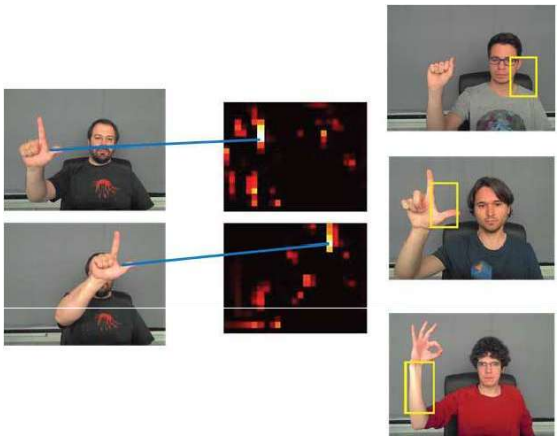

Figure 9. Convolutional Neural Network based System

Pei Xu, "A Real-time Hand Gesture Recognition and Human-Computer Interaction System", IEEE Transaction, 2017. [6]

The system which has been introduced in this paper is also based on convolutional neural network but along with Kalman filter which is able to estimate hand position. Here, system is controlling mouse events as virtual mouse by using hand gesture. This system separate palm and finger to recognize finger based recognition.

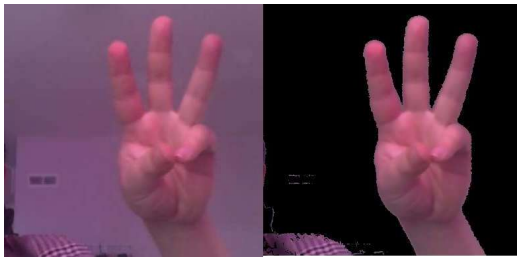

Figure 10. Hand Gesture in Plain Background

But this system also works well with plain background and not effective with non-plain background or complex background.

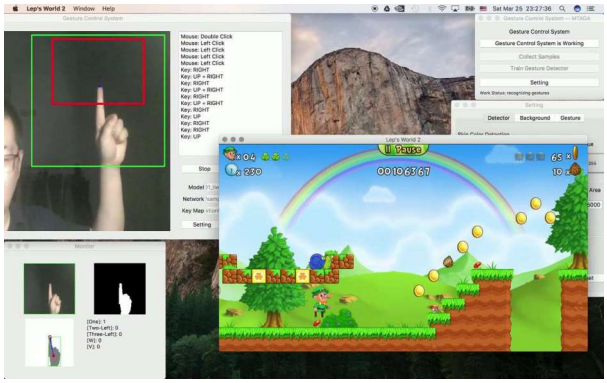

Figure 11. Hand Gesture in Plain Background

Aashni Hariaa, Archanasri Subramaniana, Nivedhitha Asokkumara, Shristi Poddara, Jyothi S Nayaka*, "Hand Gesture Recognition for Human Computer Interaction", IEEE Transaction, 2017. [7]

The system which has been proposed in this paper is based on contour extraction for creating virtual mouse through which particular application can be controlled. But the problem with this system is same earlier defined that is accuracy rate in complex background. It can only work correctly with plain background. Extracting only contour is not effective for better controlling system, this is older pattern to recognize hand gestures.

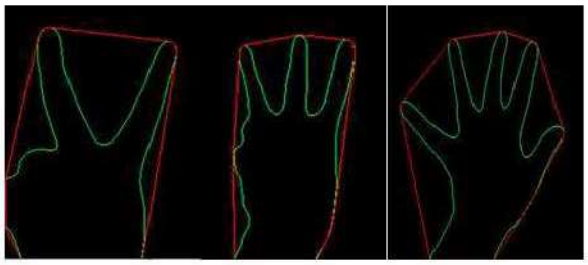

Figure 12. Contour Extraction

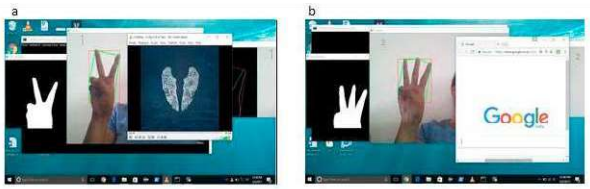

Figure 13. Contour based virtual mouse

3. PROBLEM STATEMENTS

Most of the existing systems are based MYO Armband which increases the cost of the system and limited the hand gestures for recognition and few systems are based on convolutional neural network where hand gesture works effectively with plain background, there is a problem finding hand position and gesture in complex backgrounds. Some of the systems are based on contour extraction where the same problem suffers that is background complexity. It is required to develop a system that can work in complex background with high level of accuracy, through which interaction with computer will become easy and effective. A virtual mouse can be developed by the help of that proposed system.

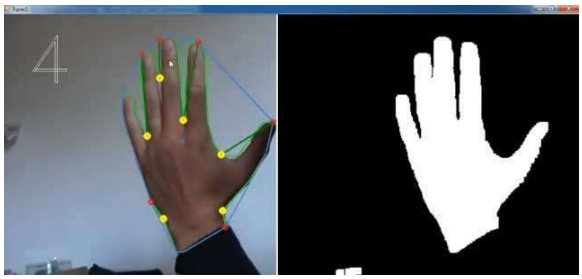

Figure 14. Hand Gesture Control

4. CONCLUSION

Thus the survey of all these systems concluded at a point that hand gesture recognition does not work well with complex background or non-plain background. All the systems are lacking somewhere due to higher error rate in non-plain background. A system requires that can fulfill these bugs and a recognition would be possible with complex background with high level of accuracy.

5. FUTURE SCOPE

The current proposed concept of hand gesture recognition can be enhanced in future by developing a system that will be able to recognize hand gesture from complex or plain background with high level of accuracy similar with plain background.

REFERENCES:

[1] Siddharth S. Rautaray1, Anupam Agrawal2, "Real Time Hand Gesture Recognition System for Dynamic Applications", IEEE Transaction, 2012.

[2] Zhi-hua Chen, Jung-Tae Kim, Jianning Liang, Jing Zhang, and Yu-Bo Yuan1, "Real-Time Hand Gesture Recognition Using Finger Segmentation", IEEE Transaction, 2014.

[3] Atharva Ajit Kadethankar and Apurv Dilip Joshi, "Dynamic Hand Gesture Recognition Using Kinect", IEEE Transaction, 2017.

[4] Marco E. Benalcázar, Cristhian Motoche, Jonathan A. Zea, Andrés G. Jaramillo, Carlos E. Anchundia, Patricio Zambrano, Marco Segura, Freddy Benalcázar Palacios and María Pérez, "Real-Time Hand Gesture Recognition Using the Myo Armband and Muscle Activity Detection", IEEE Transaction, 2017.

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[6] Pei Xu, "A Real-time Hand Gesture Recognition and Human-Computer Interaction System", IEEE Transaction, 2017.

[7] Aashni Hariaa, Archanasri Subramaniana, Nivedhitha Asokkumara, Shristi Poddara, Jyothi S Nayaka*, "Hand Gesture Recognition for Human Computer Interaction", IEEE Transaction, 2017.