WiP Abstract: A Survey of Approaches for Recognizing Hand Gestures using EMG signal

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***Abstract*— Researchers have developed diverse methods for detecting hand gestures using EMG signal. The signal of EMG sensor can be measured on a human skin surface. There are two approaches to recognizing hand gestures. One approach is to fuse EMG sensor with others sensors. It is possible to extract various motion features. Other approach uses algorithms that improve the recognition accuracy. We survey two approaches for detecting hand gestures. In future work, we plan to implement the method that can recognize various hand gestures in robust and accurate manner.**

Keywords-EMG; hand gesture; recognition algorithm

I. INTRODUCTION

There are many techniques to control electronic devices. They include remote controller, camera vision and voice recognition. Those techniques can provide the usability and the convenience to the user. However, they have limitations such as manual controlling, space constraints and low recognition accuracy.

Many studies have been tried to recognize hand gestures. Typically, glove sensors and vision sensors have been used for detecting the hand gestures. The features of hand gestures extracted from those two sensors are usually more precise than those obtained by other sensors. However, the techniques using the sensors have a few disadvantages such as space constraints with a camera and uncomfortable wearing of a glove. Another technique is to use electromyography (EMG) sensors. The data of EMG sensor can be measured on a human skin surface with a noninvasive device. To recognize hand gestures using EMG signals, there are two approaches. One approach is to use several sensors together and another approach is to apply the classification algorithms. In the next section, we present a survey of the hand gesture recognition approaches using EMG sensors.

II. SERVEY OF HAND GESTURE RECOGNITION APPROACH

A. Sensor Fusion

A sensor fusion approach typically uses EMG and other sensors such as IMU. An armband device called MYO is consisted of eight EMG sensors and IMU with three-axis gyroscope and an accelerometer [1]. This device can recognize five hand gestures from EMG signals: double tap, wave left, wave right, spread fingers and make fist. The gestures such as rotation and pan should be extracted from IMU because those cannot be obtained from EMG. The performance of this device is varies in accordance with the joint angle of the elbow.

B. Recognition Algorithm

Each person has different physical conditions such as the subcutaneous fat quantity and skin impedance. Therefore, different classifiers need to be constructed for individual person because the EMG signal is different for different physical conditions. As shown in Fig. 1, a bilinear model [2] for classifying the EMG signals can estimate hand gestures more precisely than other algorithms. The model can recognize five gestures: neutral, open, grasp, extension, and flexion. It does not consider the joint angle of the elbow.

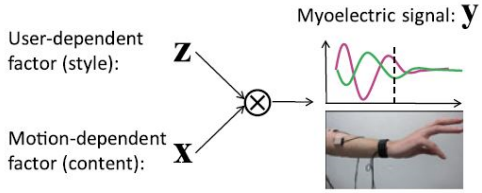

Figure 1. Bilinear model using EMG signal

III. CONCLUSION AND FUTURE WORK

In this paper, we survey the approaches to recognizing hand gestures using EMG sensors. Two approaches do not consider the joint angle of the elbow. In future work, we plan to use joint angle information to improve the accuracy of the detection of hand gestures and also increase the number of gestures that can be classified.

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REFERENCES

[1] Sathiyanarayanan, Mithileysh, and Sharanya Rajan. "MYO Armband for physiotherapy healthcare: A case study using gesture recognition application." IEEE International Conference on Communication Systems and Networks (COMSNETS), 2016.

[2] Matsubara, Takamitsu, and Jun Morimoto. "Bilinear modeling of EMG signals to extract user-independent features for multiuser myoelectric interface," IEEE Transactions on Biomedical Engineering, vol. 60, no. 8, pp. 2205-2213, 2013.