Abstract — Communication between human and hearing impair persons is very difficult in daily life. Sign language interpretation system can translate signs into text or voice for solving this problem. In practically, however, it is not convenient because it cannot be carried by the signer. It is better if the hearing impair persons can bring the sign language interpretation with themselves all the times such as fixed small camera attached to the signer shirt. The acquired image from this camera is back-hand-viewed. One important problem of the back-hand image analysis is occlusion. This paper presents a new method to recognize the back-hand images with occlusion problems. This approach consists of three steps: finger detection, tracking system and distance measurement. After input image is captured, the system will find the reference finger positions by finger-angle computation. Real-time tracking algorithm is used for checking occlusion status. Finally the system will find the occluded position from a sign database for display the meaning of the sign. Experiments show that the proposed method yields highly accurate recognition under simple implementation condition.

Index Terms — Hand detection, object tracking, hand posture, hand gesture recognition, sign language recognition

I. INTRODUCTION

Nowadays there are many disable persons in the world and around two million persons in Thailand [1]. Five hundred thousand of these persons are hearing-impaired. It is very difficult to communicate with hearing-impaired persons because they cannot speak and the audiences do not understand sign language.

Sign language is a kind of special language which is mainly depended on hand movements and facial expression. Sign language recognition can be divided into two types: glove-based and vision-based system in accordance with different devices. Glove-based system has the advantage of high recognition rate but it is not user-friendly equipments. Vision-based system is easy for user but it cannot ensure a high recognition rate.

Vision-based sign language recognition usually uses the front-view images to process the meaning of signs because the signer is in front of the fixed camera. Practically the signer communicates with normal people without the fixed camera so it is more comfortable if the signers fix the small portable camera with themselves all the times. The input images from portable camera are the back-hand images. It is difficult to achieve the high recognition rate when occluded hands occur. The system can recognize the occluded hand images efficiency by tracking a number of the input key frames. With the help of this technique, it is easy to use in daily life and the signs are interpreted into more easily understanding signals such as voice or text.

Hand detection is an important task in research on computer vision and can be applied in various applications such as sign language recognition [2], [3], remote control system [4], [5] and many applications [6]-[9]. Several approaches have been developed for detecting hand movements. Hager and Belhumeur [10] uses statistical technique to achieve partial occlusions but the system required time consuming. Lathuiliere and Herve [11] handles hand occlusion by using finger positions and 3D reconstruction but it does not robust for real time application.

Loutas et al.[12] predicts object occlusion from multiple features and Kalman filtering. Shan Lu et al. [13] integrates silhouette, edges and optical flow techniques for detecting hand but this system requires small motions. Han et al. [14] combine skin segmentation and tracking algorithm to predict occlusions among any skin objects. Choeychuen K. et al.[15] presents the robust object tracking of the ambiguous targets by a state classifier. This system will identify and track each object in the merge region by the bounding box. If the targets are the split region, these regions are identified and grouped by the expected object region.

This paper proposes the novel method for sign language interpretation system in case of occluded hands from one-view picture by the combination of the robust tracking system and the simple recognition techniques. The content of this paper is organized as follows. Proposed method is explained in section II, in section III describes the implementation and results, in Section IV provides discussion and finally, in Section V conclusion and future work are discussed.

II. PROPOSED METHOD

Overall of this system is shown in figure 1. This paper set up by using the small camera which fixed in the signer’s shirt. When the signer communicates with other peoples, the fixed camera will capture the back-hand images and sent it to the recognition part for interpret to more easily understanding signals.