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Identification of Unique Features and Exploration of Leap Motion Controller for Detecting Hand Hygiene Stages

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INTRODUCTION

Hospital acquired infections (HAIs) are contracted by the patients during the hospital stay. Antibiotic resistant microbes are the major cause and spread due to the contaminated medical equipment, crowded hospitals, frequent transfer of patients from one unit to another and poor hand hygiene. [1] In high income countries, approximately 30% of patients in intensive care units are affected by at least one HAI. [2] Hand hygiene is identified as a measure to prevent cross-transmission and to reduce the rate of HAI. [3]
Technology is now used as a means of assessing hand hygiene compliance. Current approaches involve the use of electronic counters for measuring the number of hand washing events and product usage but the quality of hand wash is not taken into consideration. There are guidelines that demonstrate how to wash hands properly as per World Health Organisation (WHO).
It is proposed that image and gesture based tracking devices may be suitable in assessing the quality of hand hygiene and adherence to accepted guidelines. In advance of implementing these approaches, this paper identifies and classifies the unique features (hand orientation and movement) for each stage of WHO guidelines. A 3D gesture tracking device (Leap Motion Controller) is then used to identify the stages based on this classification system.

MATERIALS AND METHODS

In order to classify the stages of the WHO guidelines 10 videos of health care professionals, working in a hospital or nursing school, and washing their hands according to structured guidelines were sourced. Unique identifiers that can distinguish stages from each other were carefully observed and extracted. Combinations of these identifiers can then be used to detect each hand washing stage. The corresponding value for each feature and its occurrence was recorded.
Using this approach a 3D hand tracking device (Leap Motion Controller©) was used to detect the extracted features. Leap © is a low level- low cost device that uses hardware elements and software to track key points on the hands (fingertip, palm centre etc.) and provide location in a reference frame. Leap © also provides a range of inbuilt functions and these were explored (e.g. ***palm.normal vector***, ***Hand.grab strength function*** etc.) Leap © Motion controller, however, is limited by line of sight and is subjected to occlusion when one hand blocks off the other.

RESULTS

Stage	Features	Value	Occurence
Palm to Palm	Palm Orientation	Facing each other (not facing each other)	10 (0)
	Palm shape	Flat (curved)	10 (0)
	Fingers spread	Straight and Closed (Straight and Open)	10(1)
	Hand Trajectory	Linear(Circular)	6(4)
	Frequency	Hertz	0.8-3.6 Hz
	Time duration	seconds	2 - 7 sec

Figure 1 Table illustrating unique features for WHO stage2

After dissection of the expert hand washing videos, the unique identifiers (suitable for further image processing and gesture recognition) required to describe the various stages (Classification for WHO stage 2 is shown in Figure 1) were reduced to: *1) Palm orientation, 2) Palm shape, 3) Finger spread, 4) Hand trajectory, 5) Rate of movement and 6) stage duration.* Overall duration of the entire hand washing procedure is said to be 20-30 seconds as per WHO.
Preliminary work with the Leap © has identified the optimum placement location for the 3d gesture tracking device. In the first stages of the WHO washing guidelines *Palm orientation* and *Palm shape* were critical and the Leap © could identify these. As complexity increases in advanced stages (fingers interlocked), it gets difficult to detect the features due to the occlusion of hands.

DISCUSSION

The above detailed analysis of each hand washing stage is an important step in preparation for all image processing and gesture tracking, as systems will be programmed to spot these identifiers.
The low level Leap © Motion controller is limited by the fact that it loses the target information when two hands are in contact. Other camera based techniques will be explored to in conjunction with gesture trackers to address this challenge.

REFERENCES

1. Prevention of hospital-acquired infections- A practical guide -2nd edition
2. Health care-associated infections Fact Sheet, WHO, http://www.who.int/gpsc/country_work/gpsc ccisc_fact_sheet_en.pdf
3. Pittet et al. The Lancet, vol. 356, no. 9238, pp. 1307–1312, 2000.