Improvement of a Visual-based Anthropometry Measurement System using Microsoft Kinect and a Rotating Platform

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ABSTRACT – This study involves a improvement and setup of a new anthropometry method using Kinect system with respondent rotary station. In general, measurements using visual technology have been claimed as a more accurate tool to obtain anthropometric data compared to the conventional method using manual tools. However, most of the research that has been done so far does not involve the measurement of a whole human body for ergonomics study using Kinect system. This research attempts to improve a new method using Kinect system as an advanced tool to support whole body measurement study through respondents rotary station. A 3D human model is generated and then measured using specific software. Next, the system measurements is validated and compared with the manual measurement method's results. The findings from this study can contribute to the product design requirement and applications that involves human body measurement to gain comfort for any product's user.

1. INTRODUCTION

In human-factors analysis, a known range for human body measurements can help guide the design of products to fit most people [1]. Current technology offers the collection of highly accurate anthropometric data through image analysis processing method [2]–[4], 3D body scanner [5]–[7], and Microsoft Kinect tools [8]–[10]. This significantly decreases the duration of the process and provides less error in measurement compared with the traditional method; hence it is very beneficial to be applied in the designing process.

The aim of this study is to improve a Kinect system using a respondent rotary station that able to scan and render a three dimensional (3D) model of a human body. This 3D model can be measured later using a 3D measurement software. Then, this measurement is compared with manual measurement that has been done concurrently using anthropometry manual tools.

2. METHODOLOGY

Overall, there are two main development stage in this study: the hardware development and the software development. Figure 1 shows the flowchart of this study.

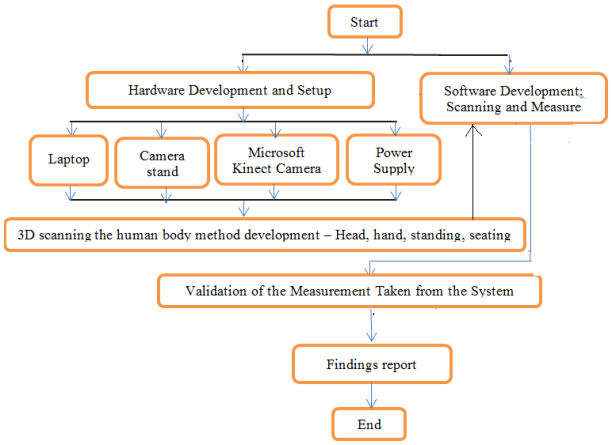

Figure 1 The Study's Methodology

The hardware development involved the setup of a laptop for easier installation of software needed for the project, an adjustable camera stand (which is custom made for this project), a Microsoft Kinect camera and a power supply. Figure 2 shows the hardware setup. For respondent's station, there is a rotator base that can rotate the respondent when he or she is being scanned by the Kinect system.

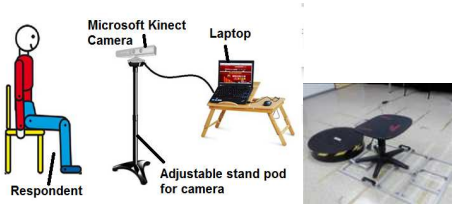

Figure 2 The Hardware Setup (Right: Respondent Station that Can Rotate)

Next, a 3D scanning procedure is developed including 8 postures that need to be mimicked by a respondent as shown in Figure 3. After that, a pretest is done with 2 male respondents with aim to validate the measurement with the manual data. 3D model for each

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respondent is then generated with Skanect software and then measured using 3D Builder software. Concurrently, a manual measurement is being done on both respondents using anthropometer and measuring tape. There are 105 parameters for whole body involved in the measurement. Then all these parameters are compared with the measurement gained with the 3D Builder software.

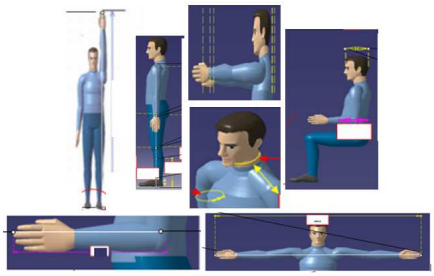

Figure 3: 8 Respondent's Posture for 3D Scanning

3. RESULTS AND DISCUSSION

Only 2 people are able to be scanned as there are problems with other 4 person's 3D data. Only 92 linear measurements are taken due to 3D Builder unable to measure circumference measurement. For both respondents, 37 parameters out of 92 were unable to be measured due to 3D Builder limitations of linear measuring. Table 1 shows the result about the number of parameter that has error percentages as described. There reason of errors is there's limitation of measuring method in software and manual measurement.

	Male 1	Male 2
< 1% difference	10	4
< 5% difference	16	17
> 5% difference	29	55

Table 1: 3D Builder Measuring Error with Manual Measurement

4. CONCLUSIONS

A Kinect anthropometry system using respondent's rotary station has been successfully developed with 8 postures that need to be scanned. There are improvements that need to be done for 3D measurement software. Due to 3D Builder limitations, alternate measuring software need to be developed.

5. ACKNOWLEDGEMENT

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