



Performance of Photogrammetry-Based Makeshift 3D Scanning System for Geometrical Object in Reverse Engineering

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Abstract: A three-dimension (3D) scanner is one of the important tools for digital reproduction of physical objects in reverse engineering. In some cases, a makeshift 3D scanner is needed immediately, such as for emergency spare parts reproduction. Thus, this research aims to investigate the feasibility of a low-cost makeshift 3D scanner using a mobile phone and the photogrammetry method in reconstructing digital 3D models of geometrical objects. A focus is given to the dimension accuracy of the reconstructed 3D models, which have been reproduced using images taken by a mobile phone, in comparison with the actual dimension of the scanned test pieces. To do so, four types of actual geometrical test pieces with dimension from 5 mm to 175 mm were fabricated using a CNC machine. 3D models of each test pieces had been developed using the photogrammetry method and compared with those developed using an industrial-grade high-end 3D scanner. It was found that mobile photogrammetry achieved an average accuracy of 97.2%, with minimum and maximum values of 83.3% and 99.9%, respectively. Geometrical dimensions less than 10 mm tend to have lower accuracy, while it was the opposite for dimensions over 150 mm. Furthermore, the scanning limit for either method was found to be a surface with a small tilting angle (less than 3 degrees). Nevertheless, photogrammetry method in combination with a mobile phone has the potential to be utilized as an alternative of a makeshift 3D scanning system with sufficient accuracy using commonly available tools.

Keywords: 3D scanning, makeshift, geometrical accuracy, photogrammetry, reverse engineering

1. Introduction

Reverse engineering involves the process of digital reconstruction of actual object into computer aided design 3D model is one of the necessities for related key players, especially in the field of mechanical and biomedical industries. An example of such a situation is when a crucial component for a machine is faulty and no spare part is immediately