UNIVERSITI TEKNOLOGI MARA

ASSESSMENT OF THREE-DIMENSIONAL MODEL GENERATED USING DIGITAL CLOSE-RANGE PHOTOGRAMMETRIC METHOD FOR HERITAGE DOCUMENTATION APPLICATIONS

ISMAIL BIN MA'AROF

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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a panel of examiners has met on 24th May 2017 to conduct the final examination of Ismail Ma'arof on his Doctor of Philosophy thesis entitled "Assessment of Three-Dimensional Model Generated using Digital Close-Range Photogrammetric Method For Heritage Documentation Applications" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners was as follows:

Sabarinah Sheikh Ahmad, PhD
Professor
Faculty of Architecture, Planning and Surveying,
Universiti Teknologi MARA
(Chairperson)

Jezan Md Diah, PhD
Senior Lecturer
Faculty of Civil Engineering,
Universiti Teknologi MARA
(Internal Examiner)

Zulkepli Majid, PhD
Associate Professor
Faculty of Geoinformation and Real Estate,
Universiti Teknologi Malaysia
(External Examiner)

Albert K. Chong, PhD
Senior Lecturer
Faculty of Health Engineering and Sciences,
University of Southern Queensland, Australia
(External Examiner)

DR. MOHAMMAD NAWAWI
DATO HAJI SEROJI
Dean
Institute of Graduates Studies
Universiti Teknologi MARA
Date: 6th June, 2017

ABSTRACT

Lately, there were a number of photogrammetric techniques developed and utilized in documenting heritage and historical monuments. Reality image based modelling technique has been frequently used to obtain an accurate measurement of the heritage building, monuments and archaeological site studies. This is in line with the current rapid changes in the development of technology. The subject, which is the heritage and historical monument, is chosen to improve the documentation process. Perhaps with this research, it will give a new drive or tools of improvement for heritage monument documentation projects in Malaysia. It is hoped that the preservation and conservation activities would be developed for the benefit of our future generation. With the enhancement and advancement of instrument being utilized and used during the historical monument documentation, it has been shown that a great number of research and studies have been done by previous researchers. This research aims to assess the 3D reconstruction model obtained from a low-cost, low-specification digital camera, in order to resolve current limitations and gaps for developing 3D models of heritage monument remains using monoscopic close-range photogrammetry image based data. Lower specification for this research is defined as having a resolution of less the state-of-the art digital camera (10-24 Megapixels). The main objective of this research is to carry out a wider investigation into current approaches used in digital documentation of heritage monuments remains. Secondly, to provide a solution for the state-of-the-art image modeling by using low cost, low specification image sensor when collecting data for 3D heritage building remains. The development of a suitable semi-automatic approach to process the data obtained from the low cost, low specification image sensor by adapting current methods and combining them with novel methods. Finally, to analyse the concept by means of empirical evaluation that leads to the justification of the 3D constructed Malaysian heritage monuments. There are various applications of photogrammetry techniques being used in documenting the heritage monument. Each of it has its own strength and weaknesses. So as the photogrammetrist, one could choose any of the techniques and at the same time improve the ability of the techniques. This approach has successfully reconstructed the structure of façade of the monuments. The time taken to produce the resulting model is almost economical with ease of use, compared to existing techniques to generate the reconstruction for documentation purposes. The produced model is also acceptable in term of measurement accuracy requirement from a regular 3D CAD drawing and can be used to assist professionals and experts in related fields. This research makes significant contributions, which includes a literature review as well as several contributions made by the hardware and the well-known commercial software itself. The review developed here consists of existing techniques in producing 3D models of building façade or structures using image based, as well as applications that could benefit from this research's model, with advances technology on the current practice.

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CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF STUDY

Photogrammetric methods has been widely used for the architectural and monument conservation works, which include the measuring and mapping techniques for the reconstruction and restoration of buildings and documentation purpose. In the recent years, the number of applications of the close range photogrammetry has increasingly been used in the heritage building and monument documentation field. This photogrammetry technique has been frequently used in order to obtain a very accurate measurement of the heritage building and in the archaeological site studies. Plus, with the rapid development in digital imaging technique, multimedia technologies and the availability of many powerful graphic applications make techniques for the building documentation feasible. The historical building has been built such a long time ago, therefore, the documentation of the historical and heritage monument is very essentials as an aid for the long-term preservation. Nowadays, a three-dimensional (3D) model of the building especially the historical and heritage building are widely used in many applications such as for tourism purpose, preservation purpose, architectural and archeological artwork purpose and many more. In making the remarkable heritage site more accessible in these day modern and virtual world, a 3D model of the monument must be prepared.

Remondino (2010) summarized that the 3D model generation is through the process as shown in Figure 1.1. The figure shows the generation of three-dimensional model which is based on using contactless methods and sensors active or passive. The reason why the specialist prefers for the digital form in generating a 3D model for the presentation rather than the traditional approach is due to the cost and its simplicity during the processing method. This is because when compared the modern approach with the traditional approach, it is cheaper to build and can easily be stored, modify and retrieved when needed. Furthermore, digital model provides a virtual model where monument or building structures can be studied and followed by the restoration and reconstruction process of partly ruined or damaged monuments can be carried out.