UNIVERSITI TEKNOLOGI MARA
Cawangan Perak
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e-Proceeding

v-GOGREEN2020

29 - 30 SEPT

VIRTUAL GO-GREEN: CONFERENCE & PUBLICATION

"SUSTAINABLE ENVIRONMENT, RESILIENCE AND SOCIAL WELL-BEING"

Organiser :
Research, Industrial Linkages, Community & Alumni Network (PJIM&A)

Co-organiser :
Faculty of Architecture, Planning and Surveying (FSPU) & Centre for Post Graduate Studies (CGS)

Publication Date : 22nd February 2021

Virtual Go-Green Conference and Publication 2020

UNIVERSITI TEKNOLOGI MARA, PERAK BRANCH
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e ISBN 978-967-2920-06-9

LANDSLIDE SUSCEPTIBILITY MAPPING USING GIS APPROACH

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Abstract

There are many approachees in monitoring landslides, but Close Range Photogrammetry (CRP) provides mapping achieved almost in real-time at a low cost compared with another approach. CRP is a conception technology which is used to acquire 3D spatial information on objects in inaccessible areas. The method concerns camera calibration, which includes a process of the determination of the right parameters of the camera. The information is obtained through accurate assessment and used to create a 3D model which would be used for monitoring technique applications. In this study, calibration of the digital camera was performed using PhotoModeler Pro 5. A good calibration will have many points marked. Field observations of the on-site survey were carried out over a monitoring area in Parit, Seri Iskandar, Perak. The landslide can be detected by the calculation of two different epoch data achieved from the Digital Elevation Model (DEM) generation. The paper focuses on the observation of the studied area based on DEM area and volume generated from the 3D surface analysis.

Keywords: *digital elevation model (DEM); close range photogrammetry (CRP); 3D model; calibration; monitoring.*

1.0 INTRODUCTION

Digital elevation models (DEM) can be generated from several techniques like topographic survey, Global Positioning Systems (GPS), digitizing of a topographic map, aerial photogrammetry, airborne and terrestrial laser scanning and terrestrial photogrammetry or known as close-range photogrammetry technique[1].

DEM data consists of x (Easting), y (Northing), and z height value due to the surface area that represents DEM data from observation data collected. The surface measurement can detect and compute the volume from the comparison between two epochs data obtained from DEM. DEM data is a valuable source for many applications, primarily used to study for surface movement.

The most critical point in obtaining DEM is that the method is comparatively low in cost. As we know, there are some techniques in generating DEM, which can be performed by using direct or remote measurement on the landslide area. An alternative solution to conduct this research is by using terrestrial photogrammetry or known as close-range photogrammetry.

2.0 RESEARCH SIGNIFICANCE

In this study, the main question in producing 3D issues addressed is the selection of a lower cost method to produce DEM. A variety of other techniques to generate DEM data acquisition is available. The basic construction to obtain DEM is by using conventional ground survey, GPS, and Remote Sensing.

Conventional terrestrial surveying provides a total station as equipment to measure 3D coordinates of a point on the surface area remotely. This technique is only providing one-dimensional information of the monitoring area. On the other hand, the manpower should

traverse directly on the risky surface [1]. GPS technique approach is by code pseudo-range or phase pseudo-range Static surveying, which requires time ranges from 30 minutes to several hours, and kinematic approach allows many points to be measured in a short period but with reduced accuracy concerning static survey [2].

All this description techniques need direct observation on the surface, and it is impossible to place the equipment on a high and steep slope. Besides that, remote sensing application can be provided to monitor inaccessible area but requires an expensive platform in the application of monitoring

3.0 MATERIALS AND METHOD

In this paper,close-range photogrammetry is described as a technique to obtain information means of position, size and shape of theobject by measurement of images by direct conduct [3].The main objective of this research is to present thecapability of close-range photogrammetry as a data acquisition tool in generating DEM by using data from the surface area. The flowchart in Fig.1 describes the phases of activities in the surface monitoring measurement process in this simulation research study.

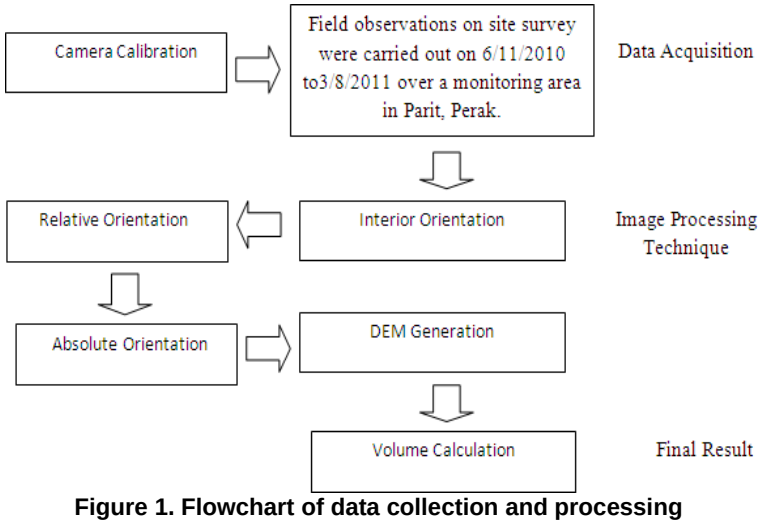

Figure 1. Flowchart of data collection and processing

Two sets of data observations were conducted from November 2010 through August 2011.The results were generated quickly after data acquisition so that the next stage for data processing can be made quickly. DEM generated data from a stereo photograph has been validated using ground control points (GCPs).

The precision of three-dimensional coordinates of apoint depends on scale image and the resolution. Other factors that can affect the final precision of the product are the capacity of the correlation algorithms to process at the sub-pixel level, the presence of shadows and morphology of the surface, and the quality of the original image

The processing of the images is done by matching well-defined colour levels and shape in the corresponding area of the images [4]. Ground control points orient the digital images, and the locations of points were surveyed with a reflectorless total station. An independent ground survey has determined ground control points (GCPs) in the photographs. GCPs aim to provide identified locations within the stereo overlap which have known coordinates. Six GCPs were well distributed around the slope surface, and the position was ensured to be recognized on the overlapping photographs.

4.0 RESULTS AND ANALYSIS

The results and analysis of the field data demonstrate that close-range photogrammetry (CRP) application can be adopted in showing an integrated monitoring technique in surface measurement involved in a landslide. From the two sets of epoch data shown in Fig2 and Fig.3, the three-dimensional Digital Elevation Model (DEM) was performed with Close Range Photogrammetry (CRP) application.

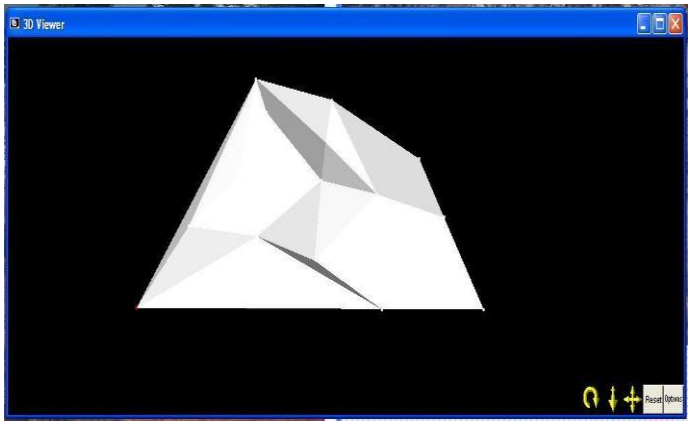

Figure 2. From Epoch 1 (3D)

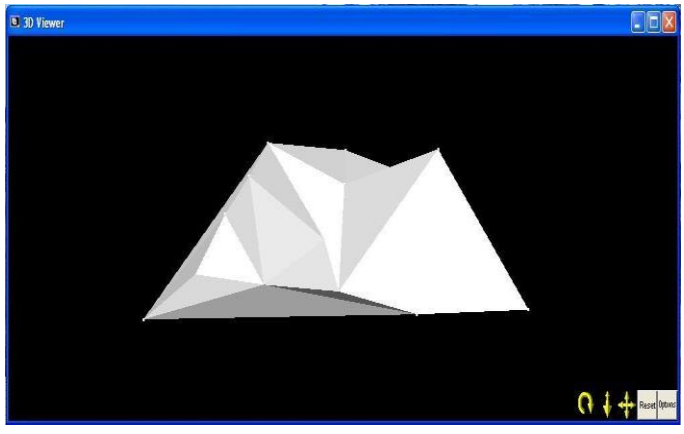

Figure 3. From Epoch 2 (3D)

The analysis of landslide monitoring was also conducted, referring to the two different epoch data calculated. To study the effectiveness of the close-range photogrammetry technique in generating 3D on the study area applied, two observations were conducted to determine the change of physical surfaces. Analysis of the graph in Fig.4 determines the profile of slopes from 6/11/2010 to 3/8/2011 where a change of elevation is detected with mass movement from the top view of the slope moving downward. A further analysis was done by comparing height differences between both DEMs.

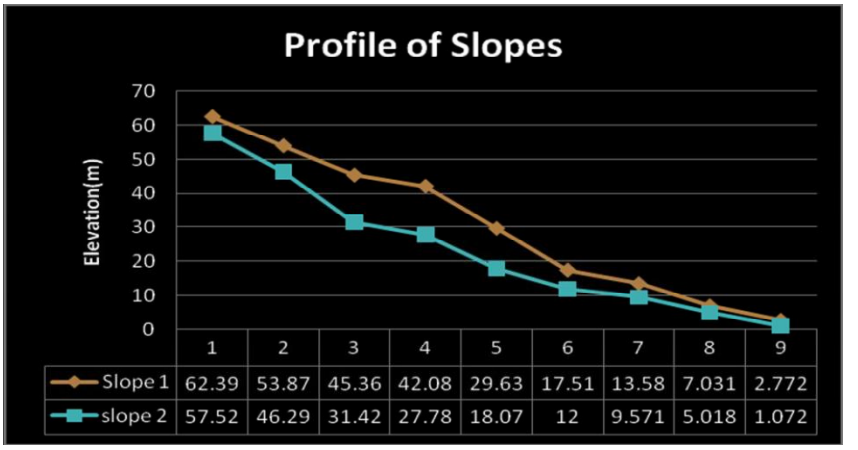

Figure 4. Profile of slopes

5.0 RESULTS AND DISCUSSIONS

In this study, the method of applying close-range photogrammetry technique in performing 3D object measurement is proven valid to obtain a Digital Elevation Model (DEM) for landslide monitoring. This approach can solve problems that arise in risky places and at the same time, can provide reduced cost and is simple and effective. Besides that, the actual time of observation in field data collected is only two hours for the observation to be accomplished. From a combination of control points in surveying, close-range photogrammetry technique can be applied to generate Digital Elevation Model (DEM). DEM generated at different epochs can determine displacements part of a landslide. Further studies in the future in generating DEM by using other applications that can provide better techniques are required.

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Sekian, terima kasih.

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Saya yang menjalankan amanah,

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nar

Setuju.

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