

A study on slope monitoring and stability analysis using unmanned aerial vehicles

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The slope stability in Taiwan are generally vulnerable due to the natural adverse conditions such as younger strata, steep topography, weak geology, active orogeny, repeated earthquakes, weathering and erosion, frequent typhoons, high rainfall, etc. Furthermore, the human factors like immature law and regulations, the weak execution, and improper land use and development also play an important role in reducing the slope stability. These factors to some degree worsen the slope conditions, lead to a more frequent natural disaster and cause the loss of life and property.

As global warming and weather extremes accelerated, the occurrence probability of super typhoon and torrential rain apparently soars. The typhoon Morakot in 2009 set a new record of rainfall and resulted in numerous severe landslides and debris flows in mountain areas of central and southern part of Taiwan, the collapsed and exposed area is added about 369 square kilometers.

Current data collection approaches in slope monitoring and warning system are primarily based on in situ measurements, provide high precision and multiple measurement purpose, however, the installment and maintenance costs are high, and the monitor area is limited.

The purpose of this study is to achieve a prompt response in slope disaster for prevention and rescue by using unmanned aerial vehicles(UAVs). With the advantages of UAVs, the digital image with high resolutions for a wide area without terrain restrictions can be obtained efficiently. The raw data are processed, computed, and mapped to generate a precise three-dimensional digital image data by a dynamic post-processing model integrated with differential measurement. In this research, a numerical slope sensitivity analysis model is developed. Further, a three-dimensional topographic map, slope environments and stability analysis are established and performed by using ArcGIS, and the slope deformation can be obtained by comparing with digital image data of different times. The results from this study can be used in slope management and precaution, investigation and analysis, rescue and recovery, stability monitor, renovation and improvement, etc.

Keywords: Unmanned aerial vehicle(UAV), slope disasters, digital image, slope stability analysis

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Chung Cheng Institute of Technology, Taiwan, R.O.C**Abstract**

The slope stability in Taiwan are generally vulnerable due to the natural adverse conditions such as younger strata, steep topography, weak geology, active orogeny, repeated earthquakes, weathering and erosion, frequent typhoons, high rainfall, etc. Furthermore, the human factors like immature law and regulations, the weak execution, and improper land use and development also play an important role in reducing the slope stability. These factors to some degree worsen the slope conditions, lead to a more frequent natural disaster and cause the loss of life and property.

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