

Unmanned Aerial Vehicle (UAV) for Topographical Mapping of Inaccessible Land Areas in Ghana: a Cost Effective Approach

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Key words: Engineering survey; Geoinformation/GI; GNSS/GPS; Low cost technology; Mine surveying; Photogrammetry; Positioning; Spatial planning

SUMMARY

The use of Unmanned Aerial Vehicles (UAVs) for remote data acquisition has rapidly evolved in recent years. This integration of UAV with Global Positioning System (GPS) and Geographic Information System (GIS) techniques have reduced time and cost in acquiring data for inaccessible land areas without vegetation cover. Topographical mapping of water bodies, marshy areas or land areas without land cover using traditional methods of surveying in Ghana is time consuming and challenging. This study considered topographical mapping of muddy tailings dam sites at a rain forest mining area at Osino in the East Region of Ghana. DJI Phantom 4 Pro consumer UAV was flown at an altitude of 75 meters in a 3D flight mode. Real Time Kinematic (RTK) GPS was used to coordinate a reflective-marked Ground Control Point (GCP) and surveying accessible areas near the study area. Georeferencing the orthophoto was done using the GCP. Digital Terrain Model (DTM) was generated from the processed orthophotos after which XYZ values at five meters interval were generated. Contours were generated and cross sections across the tailings dam were drawn for further geotechnical and stability analysis for the tailings dam. The accuracy of the topographic map is 5 cm and confirms the suitability of using consumer grade UAVs for topographical mapping of inaccessible areas in a cost-effective manner. Thus, the integration of RTK technology with the UAV and GIS is a feasible and appropriately accurate solution for mapping inaccessible areas without vegetation cover.

Keywords: Unmanned Aerial Vehicle (UAV), Global Positioning System (GPS), Geographic Information System (GIS), Tailings Dam, Inaccessible Land Areas, Ground Control Point (GCP)

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