Application of UAV-based Photogrammetry in Monitoring Slope Deformations in Open Pit Mining Environments: A Systematic Review

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SUMMARY

Mine surveyors play a critical role in assessing and monitoring slope deformations in open pit mining environments. Monitoring the stability and deformation of open pit slopes is crucial to minimize hazards at mining sites. However, traditional survey methods for monitoring slope deformations, such as precise levelling, total station surveys, and GPS surveys, can be limited in terms of coverage as the pit advances, accessibility, and safety of the survey crew. Unoccupied Aerial Vehicle (UAV) based photogrammetry is an emerging technology that is gaining prominence in monitoring open pit slope deformations. The review aims to summarize the current knowledge, perspectives and potential areas for future exploration of this emerging monitoring methodology for open pit mines. The research used "Preferred Reporting Items for Systematic Review and Meta-Analysis": the keywords used were "mine", "slope" and "photogrammetry") combined with the words "open pit", "temporal analysis", "UAV" and "deformation monitoring" and applied to the most appropriate databases. 47 records were initially identified; after applying exclusion criteria (such as year, document type, source type, language) and after an initial review of each study title, 30 articles were considered eligible. Records were examined in full text to obtain the required information, leaving only 24 records. Most studies utilized photogrammetric techniques (using unoccupied aerial vehicles) to monitor open pit slope deformations. Both the advantages and limitations of using UAV-based photogrammetry to monitor open pit slope deformations were noted using case studies. There is a need to conduct more research on the temporal and off nadir displacement problems that were identified in the review. Addressing these research gaps will lead to effective and robust harnessing of UAV-based photogrammetry in monitoring slope deformations in open pit mining operations.
