Application Study of UAV Technology in Tailings Pond Monitoring

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ABSTRACT

The frequent occurrence of dam failures since the 21st century has prompted scholars to re-examine tailings pond monitoring. The current "Safety Regulation for Tailings Pond" in China has established monitoring parameters, encompassing dam displacement, seepage line, beach distance and slope, precipitation, water level, geological landslide displacement in the reservoir area, and the inflow and outflow of dam and drainage systems. According to the regulation, different grades of tailings ponds are mandated to set up online monitoring systems and conduct manual inspections. To broaden the monitoring perspective and enhance overall effectiveness, a method for tailings pond inspection and observation based on unmanned aerial vehicle (UAV) surveying and deep learning models is proposed. This innovative approach represents an upgrade from the traditional "point observation" monitoring method to a more comprehensive "whole cross-section" observation, thereby significantly improving data collection efficiency. The procedural methods of utilizing UAV technology in scenarios such as beach boundary line identification, beach slope measurement, and reservoir capacity change observation are outlined. Additionally, the results obtained from UAV surveying are strategically applied to dam failure numerical simulation prediction and risk assessment. This involves constructing a three-dimensional geometric model that incorporates detailed terrain information to derive a more reliable potential dam failure path. The simulation results are of practical value in various aspects, including site planning, design and construction, expansion, heightening, and emergency plan formulation. In conclusion, UAV technology holds broad prospects in the field of tailings pond monitoring and will be playing a crucial role in minimizing the risk and reducing the harm associated with tailings pond disasters.