Development of Landslide Monitoring System by Real-Time Kinematic Survey: Experimentation and Application in Mae Moh Mine, Thailand

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SUMMARY

The research aims to develop a Landslide Monitoring System based on RTK GNSS positioning to reduce damages caused by landslides in Mae Moh Lignite open-pit mine. The system, which is called LANDMOS, has a hardy body suitable for harsh environment and be able to survive some degree of damage. The LANDMOS relies on solar energy with battery storage. The system continuously operates for 24 hours to analyze the effects of landslides, which are induced by mining activities, and the behavior of slopes through 10 monitoring stations distributed across the pit mine and dumping areas. Each station includes a built-in low-cost RTK GNSS receiver, data acquisition equipment, and a 4G LTE communication device. The system efficiently manages a sizeable number of real-time GNSS monitoring raw data transmitted to a central computer server from the on-site stations while the movement data can be accessed via web application all the time. When the movement exceeds tolerance criteria, the system will turn on the warning light integrated into each LANDMOS unit, furthermore, the warning message will be sent to all participants in real-time via Line-application. Through data processing with additional outlier detection consideration, the evaluation of experimental test results revealed that three-dimensional movement determination was achievable as accurately as 5 centimeters or better.

The system also enabled the detection of land deformation and sent early-warning messages concerning the high risk of landslides. LANDMOS has started operating from 25 November 2021 onward and efficiently enhances the management of might-happened disasters, so the employees and nearby communities co-exist with Mae Moh Mine with the safety of life and property. At first, the on-site stations were placed in the upper north part of the west-side dumping area of the Mae Moh mine, then were moved to the riskier area as time flew by. In particular, LANDMOS helps to ensure the safety of mine facilities, which results in the stability of the coal providing so that the power plants can constantly generate electricity to ensure the security and sustainable energy of

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