Smart Technologies for Emergency Response and Disaster Management of Hillslope Community

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Since Taiwan is highly exposed to natural disasters, and there are more frequent extreme weather phenomena nowadays, such as monsoon and typhoons brought by climate change, which caused higher intensity(>100mm/1hr) and larger accumulated rainfall (>1000mm/72hrs) in the last 2 decades, the safety of hillslope community becomes much more critical.

The safety assessment includes the stability of natural slopes and artificial slopes. Therefore, the remote sensing and smart technologies were applied to several hillslope communities in New Taipei City to evaluate and rank the risks of these hillslope communities. On this foundation, the monitoring system of the slopes at high risks is deployed for emergency response and disaster management.

It has been aware that the effect of artificial slopes was difficult to be reflected in a regional risk assessment model, such as on a township scale. Thus, the study aims to establish a risk assessment model for slope land with consideration of both natural and artificial slopes. Moreover, the potential hazard impact induced by the extreme rainfall is also addressed in this study. The residential hillslope communities at high risk are taken for examples in the research to evaluate the impact and to provide the adaptive coping strategies in advance.

The smart technologies, including IoT(Internet of Things) and cloud platform, provide the visualization and real time in-situ information in this study. Traditionally the automatic real-time monitoring system was not just expensive, but also complicated and hard to maintain, which couldn't be afforded by aged hillslope communities. With the prevalence of electronic devices, increasing innovative and standard components are readily available these days. In view of this, The study aims to

develop a monitoring platform based on the low-cost, low-power intelligent sensors, and cloud services for rainfall-induced landslides.

In this special monitoring system, a soil moisture sensor, a combined temperature, humidity and atmospheric pressure sensor, a rain gauge, an inertial measuring unit (IMU), and an inclinometer, are integrated into a micro-electro-mechanical system (MEMS) based smart sensing stick. The field monitoring data is thereby transmitted wirelessly to the remote server and saved into the Building Management Resume Database (BMRD), which had been built before this study. The project will also enable a big data analysis platform to analyze the field monitoring data. The results from this analysis platform can provide better disaster mitigation, emergency evacuation planning and risk management in hillslope communities.

It is crucial to set up a remote monitoring system and to utilize the in-situ sensors for the vulnerable hillslope communities. Both public and private sectors should be engaged to collect post-event and real-time data regarding the hazard/risk maps for disaster prevention and emergency response. Furthermore, the loss and damage of the hillslope community can also be estimated by risk management mechanism.

To make full use of the smart technology such as cloud analysis, monitoring network and low-power-consumption/long-distance transmission for effective communication among government agencies, enterprises and general public are the core of innovation and disaster prevention. With the introduction of IoT sensors, it has been easier and faster than ever to collect in-situ information and history visualization of the slope environment.

Taiwan has rich experience in ICT (Information & Communication technology) and disaster prevention. Through establishing the smart-technology-based total solutions for emergency response and disaster management, the life quality of hillslope communities can be enhanced; ultimately to create a resilient and sustainable city.

Keywords：extreme rainfall, hillslope community, IoT, Big Data, hazard impact, adaptation strategy.