Engineers develop a ground and structure collapse detection sensor

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Photo of the site attaching the developed sensor in the lava cave. Credit: Korea Institute of Civil Engineering and Building Technology

The Korea Institute of Civil Engineering and Building Technology (KICT) have developed a smart sensor that detects signs of ground or structure collapses and a real-time remote monitoring system.

The development of the sensor and system began with a search for a method to instantly sense the collapse of slopes or buildings caused by ground movement to enable immediate response. This led to the development of a smart sensor that turns on an LED warning light upon detecting ground movement. Existing systems that measure ground movement are not widely employed because they are intended for use by experts and are costly and difficult to use.

Dr. Baek, Yong at the Department of Geotechnical Engineering Research at KICT, thermal camera and image sensor venture company Emtake, and KICTs 1st Research-based Spin-off Company JAK Co., Ltd., jointly developed highly efficient, entry-level sensors and systems that can be deployed for continuous monitoring of ground movement in high-risk areas.

The sensors can be easily installed 1m ~ 2m apart in areas susceptible to collapses. They detect changes in slope as subtle as 0.03°. Upon sensing signs of a collapse, they immediately turn on an LED light to give a warning. The sensors have highly efficient optical transmitting lens technology, so the LED alert is visible to the naked eye even at a distance of 100 meters at day or night. When the warning light turns on, those in the situation room can remotely ascertain what is happening in the affected area in real time. This helps them take additional measures, such as sharing the developments of the collapse with the appropriate authorities.

Front view of road cut slope site photo(Uljin, Korea) with developed sensor attached. Credit: Korea Institute of Civil Engineering and Building Technology

The sensors are much easier to install and cost much less than existing sensors, and their cost of installation and operation are more than 50% lower. In addition, they can run almost a year without battery replacement thanks to their ultra-low power consumption. The sensors are expected to be widely used in areas with distinct seasonal variations because they endure and function well even at extreme temperatures of −30°C to 80°C.

To prevent false alarms, an algorithm in the sensors analyzes and

evaluates the risk based on the conditions of the monitored locations. The sensors can be used at sites of construction, public works, tunneling work, dilapidated buildings, and historical properties, as well as mines, underground structures, areas susceptible to landslides, and so forth.

The sensors were installed on a pilot basis in lava tubes on Jejudo Island, cut slopes alongside national roads and slopes in mountainous areas, and alongside the GTX-A high-speed railways in the Seoul metropolitan area. It is expected that they will be installed at more and more sites of major construction projects as well as building demolitions.

Dr. Baek said, "The current detection technology cannot respond very quickly to a collapse because it takes so much time to analyze and interpret the data. This new sensor technology will greatly reduce the time to take action and, therefore, do a great deal to help prevent and respond to collapses," he added.

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