Development of Technology for Collecting, Integrating, and Sharing Infrastructure Damage Information in Real-Time

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1. Introduction

Information on infrastructure damage is important towards making disaster response decisions. However, with large scale disasters and disasters that occur at night, collecting information is difficult and an information blackout period ensue. In order to collect information promptly and appropriately, the National Institute for Land and Infrastructure Management (NILIM) has since 2014 been developing technology to effectively use existing CCTV cameras and satellites to promptly grasp infrastructure damage, through the Cross-Ministerial Strategic Innovation Promotion Program (SIP).

Development reached the prototype stage and the technology was partially deployed in fiscal 2017. It began providing information to Regional Development Bureaus in fiscal 2018. In this report, the developed technology and situation as of fiscal 2018 are introduced.

2. Development of an initial disaster response support system

A system was developed with functions for estimating damage to road bridges and fills and determine risk of liquefaction, and automatically distributing information that enables the scale of infrastructure damage to be estimated, as well as a list of CCTV camera at the time of earthquake (Fig-1). This system is managed in a cloud environment. Users can access it via a web service, if issued a login ID and password. (IDs are issued only to persons concerned.) The automatic distribution function (Fig-1②③)does not require an ID and provides information to officials of related organizations who are in charge of disaster prevention, such as the eight Regional Development Bureaus in Japan. Moreover, the system was updated with functions for correlating seismic information blackout areas (Fig-2). In fiscal 2018, this system provided information that supported the disaster response following earthquakes in the northern part of Osaka Prefecture and Iburi, Hokkaido.

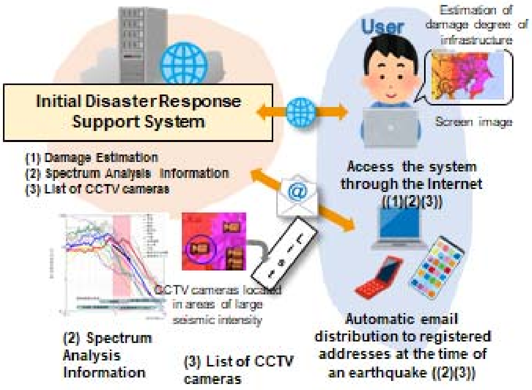

Fig-1 Illustrated view of initial disaster response support system

Fig-2 Updated system with list of CCTV cameras

3. Damage detection by enhanced utilization of SAR imagery

To examine optimal ways to use SAR observation and

so forth, the initial survey conducted of the wide-area disaster and an algorithm and system for survey planning support were examined and developed.
The algorithm was determined to comprehensively analyze the following conditions: the operating condition of the “sensor platform”; satellites and aircraft to be used at the time of disaster; the environmental conditions at the time of disaster such as time, weather, and the airports to be used; and prioritized items such as range and time.　Based on the results of trial applications at Regional Development Bureaus that started in July 2018, this system was updated to enhance the usability and so forth.
To grasp the damage information promptly and accurately, a SAR image interpretation support system has been constructed.　It has also been developed to interpret SAR image more efficiently, improve the operability of the system, reduce task processing time, and increase the processing speed.
NILIM has already used this system on a trial basis to monitor hillside collapse and other events immediately following disasters.　In fact, results provided to MLIT after heavy rains in Western Japan in July 2018 were utilized in disaster response (Fig-3).
Training for officials in charge of disaster prevention is carried out to advance nationwide efforts to introduce this system on a trial basis.

4.　Damage detection by enhanced utilization of CCTV cameras

CCTV cameras have been installed to monitor infrastructure throughout the country by MLIT.　At the time of a disaster, in order to rotate the cameras and confirm the surroundings, it is necessary to operate individual cameras manually.　For this reason、

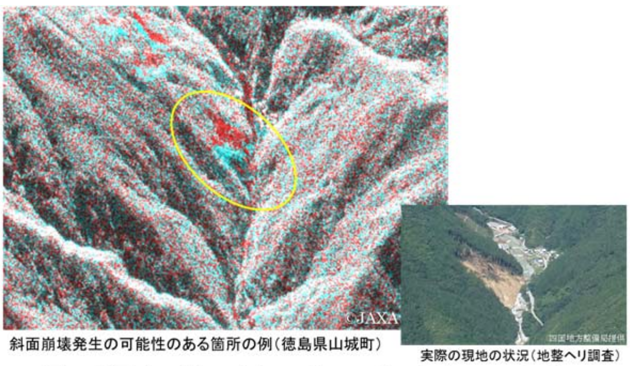

Fig-3 Prioritized locations for interpretation highlighted in red and blue in a SAR image （Fiscal 2018 heavy rain）

(1) a function that automatically rotates the CCTV cameras and captures a panoramic image and (2) an image measurement system were developed and are being tested.
(1)Test of camera panning system
Figure 4 shows a panoramic image captured by this system. In this case, the situation across a wide area can be automatically visualized. In the future, a “Guideline for Introduction” is planned.

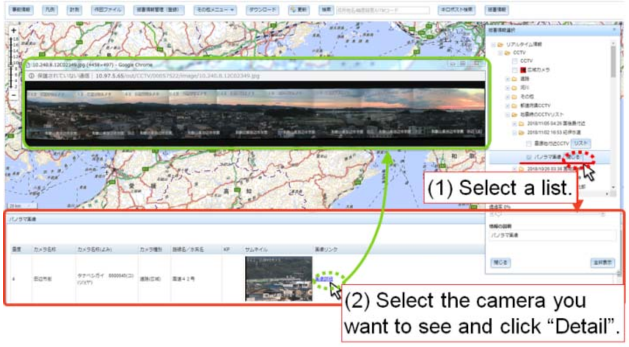

Fig-4 Panoramic image laid over the screen of DiMAPS (Sample image)

(2) Development and testing of an image measurement system
Technology that measures the width and height of an object on the screen from coordinate information by superimposing CCTV camera images on point cloud data was developed and is now in the prototype stage (Fig-5).　This technology safely and promptly measures the damage scale by remote control without staff having to access the field.　This technology was tested by using cameras in operation and surrounding data.　In order to familiarize concerned persons with the system, a guideline for introduction was proposed.

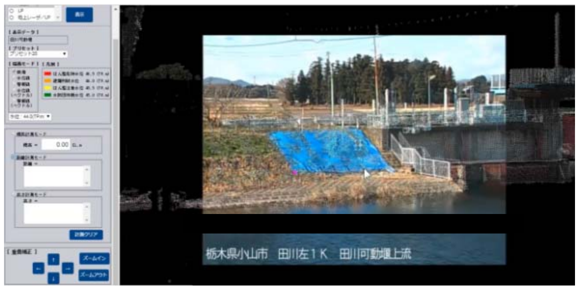

Fig-5 Sample image from the image measurement system

5.　Conclusion

The results of development has been managed and revised and make efforts to support disaster response after the end of SIP.

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