A STUDY ON SATELLITE IMAGE APPLIED TO DISASTER PREVENTION MAP

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ABSTRACT: Taiwan is situated in Asia pacific region with risk for natural disaster especially the occurrence of the frequent typhoons in every year between July and October. People are under serious threat from different aspects of disasters such as flood, mudslide, devastated road and river floods due to the torrential rain. Integration of those disasters information becomes a critical issue in recently year. With the advance of the modern spatial information technology, electronic map service is very mature, coupled with the popularity of mobile phones and personal computers. The masses can easily to share information on the internet. The remotely sensed visible imagery has been used in various fields. The main characteristics of visible imagery are high spatial resolution, stable geometry, and rich information appropriate for human vision. It is also the most important reference for the disaster prevention and management applications. In this study, we take advantage of web crawler technique to collect the data in the internet for the typhoon event happened on 2016 (including Meranti, Nepartak, Megi and Aere). Those structured data were scraped from the webpage and build an index in the database for search engine. One the other hand, orthorectification of FORMOSAT-2 and THEOS satellite image was published with WMTS Tile Server to compare pre- and post-disaster conditions. That information is integrated in to a single geographic platform, using GOOGLE as system basemap to support disaster prevention.

1. INTRODUCTION

Global warming has gradually become obvious, thus created the climate change in recently year. Taiwan is situated in Asia pacific region with risk for natural disaster especially the occurrence of the frequent typhoons in every year between July and October. These typhoons are usually accompanied by high intensity of strong winds and wide-spread rainfall, People are under serious threat from different aspects of disasters such as flood, mudslide, devastated road and river floods. How to integrate the location of each disaster to understand the frequency of its occurrence to further prevent the occurrence of disasters. Integration of those disasters information becomes a critical issue in recently year.

With the advance of the modern spatial information technology, electronic map service is very mature, coupled with the popularity of mobile phones and personal computers. The masses can easily to share information on the internet. When the disaster occurs, the masses can take pictures immediately and upload the disaster location information to the web platform, integrate the information, get more information and take the necessary relief operations. The remotely sensed visible imagery has been used in various fields. The main characteristics of visible imagery are high spatial resolution, stable geometry, and rich information appropriate for human vision. We can combine disaster information and remotely sensed visible imagery, it is the most important reference for the disaster prevention and management applications.

In this study, we take advantage of web crawler technique to collect the data in the internet for the typhoon event happened on 2016 (including Meranti, Nepartak, Megi and Aere) and typhoon Morakot happened on 2009. Those structured data was scraped from the webpage and build an index in the database for search engine. On the other hand, orthorectification of FORMOSAT-2 and THEOS satellite image was published with WMTS TileServer to compare pre- and post-disaster conditions. That information is integrated in to a single geographic platform, using GOOGLE as system basemap to support disaster prevention.

2. MATERIAL AND METHODS

2.1 Web design tool

We used an open source tool to build our website, the main logical language of the site used python, framework used Django and database management system used PostgreSQL. Python is widely used high-level programming language for general purpose programming, created by Guido van Rossum and first released in 1991. Django is a high-level Python Web framework that encourages rapid development and clean, pragmatic design, it takes care of much of the hassle of Web development. PostgreSQL, is an object-relational database management system (ORDBMS) with an emphasis on extensibility and standards compliance.

2.2 Satellite Image

We used FORMOSAT-2 and THEOS satellite image as a comparison before and after the disaster. FORMOSAT-2 is a decommissioned Earth observation satellite operated by the National Space Organization (NSPO) of Taiwan. FORMOSAT-2 is Sun-synchronous orbit at altitude of 891 kilometers, passes through Taiwan twice daily. THEOS is an Earth observation mission of Thailand, developed at EADS Astrium, Toulouse, France. Satellite basic information is in Table 1.

Table 1. Basic satellite information of FORMOSAT-2 and THEOS

Satellite	FORMOSAT-2	THEOS
Date of launch	21 May 2004(Taiwan time)	01 October 2008
Orbit height	891 km	822 km
Orbit type	Sun-synchronous orbit	Sun-synchronous near-circular
Repeat cycle	passes through Taiwan twice daily	26 days
Wavelength	Panchromatic: 0.45 – 0.90 μm Multispectral (Blue): 0.45~0.52μm Multispectral (Green): 0.52~0.60μm Multispectral (red): 0.63~0.69μm Multispectral (near infrared): 0.76~0.90μm	Panchromatic: 0.45 – 0.90 μm Multispectral (Blue): 0.45~0.52μm Multispectral (Green): 0.53~0.60μm Multispectral (red): 0.62~0.69μm Multispectral (near infrared): 0.77~0.90μm
Resolution	Panchromatic band：2 m Multispectral bands：8 m	Panchromatic band：2 m Multispectral bands：15 m
Swath Width	24 km	PAN Camera: 22 km MS Camera: 90 km

2.3 Web Map Tile Service (WMTS)

WMTS is a standard protocol for serving pre- rendered georeferenced map tiles over the Internet. The specification 1.0.0 was developed and first published by the Open Geospatial Consortium (OGC) in 2010. Three main systems of tile addressing: Google Map XYZ, Microsoft Bing Map (QuadTree) and Tile Map Service (TMS). WMTS is a successor to the TMS standard and has more features.

2.4 Method

The following steps illustrate the process of the website:

(1) Create disaster information on website: As show in Fig. 1, Disaster information is divided into two parts, the first part is the json file of the disaster information obtained from the web, we used python automation to parsing json file which to select the desired name, location, time, image and other information into the database. The second part is that we can manually enter the disaster location data into the database.

(a)

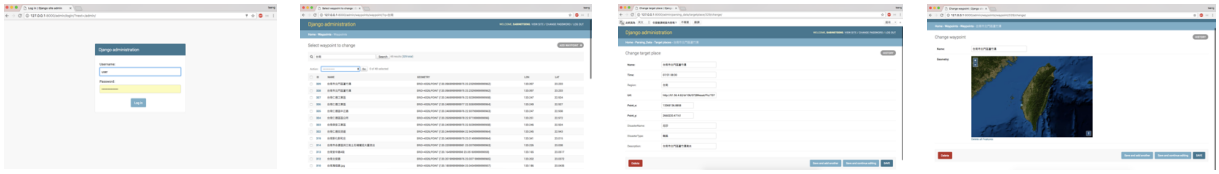
(b)

(c)

Figure 1. (a) Automation to parsing json file. (b) Manually type the disaster location data. (c) By parsing json file from the web, it has automatically stored the disaster information in the database.

(2) All disaster information can be managed through the website administer system, can be insert, update, delete

and query (as show in Fig. 2).



(a) (b) (c) (d)

Figure 2. (a) website administer system (b) query (c) update or delete (d) disaster location on google map

(3) According to these disaster information, orthorectification of cloudless satellite image was published with WMTS Tile Server to compare pre- and post-disaster conditions. We can know the latest disaster information.

3. RESULT

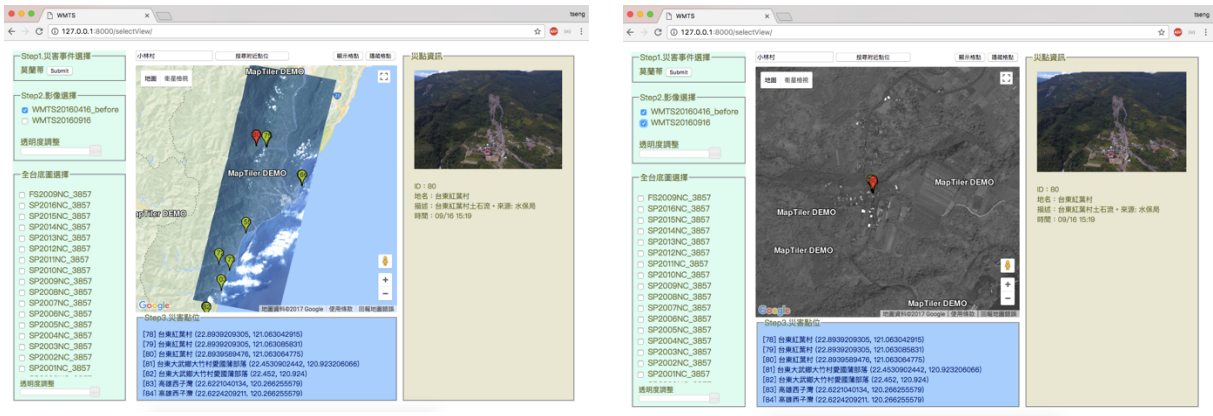
This website combines disaster information on the web and use instant satellite imagery to published WMTS, you can immediately understand the disaster location of the situation. Case 1 the disaster event was typhoon Morakot happened on 2009. As show in Fig. 3, it is the web site main page, Step1 can choose disaster events, Step2 can choose satellite image and Step3 can select a disaster point where the information for that point will appear on the map and the right field. As show in Fig. 4, it is the satellite image to compare pre- and post-disaster conditions.

Figure 3. The web site main page.

(a) (b)

Figure 4. (a) WMTS of before disaster (b)WMTS of after disaster

Case 2 was the typhoon Meranti happened on 2016. As show in Fig. 5, (a) was before disaster, it used FORMOSAT-2 fusion image to published WMTS, (b) was after disaster, it used THEOS panchromatic image to published. We can see the location of the disaster is the occurrence of landslide, to published real-time satellite images of WMTS can provide more information.



(a) (b)

Figure 5. (a) WMTS of before disaster (b)WMTS of after disaster

We can also refer to the Taiwan's WMTS map to compare the disaster image. As show in Fig.6, the bottom left of the field can choose different years of Taiwan base map.

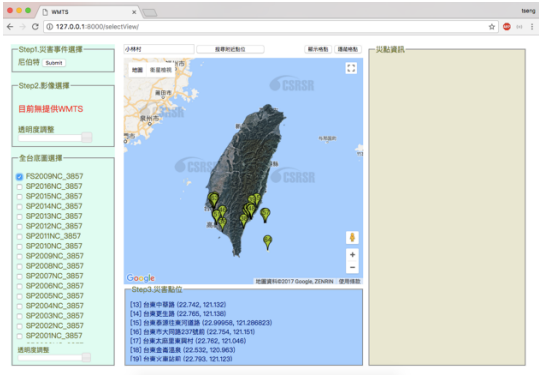


Figure 6. Choose base map

4. CONCLUSION

In this study, we establish a website which is capable of gathering information over internet by parsing JSON file when the disaster occurred. Together with user edited data, the information is stored in relational database and software program is able to retrieve and manage those data by using structured manner. Furthermore, we take advantage of Google mapping services as system base map and also publish a tiled map service from amounts of timely satellite images. The image content associate with abundant disaster information is benefit in the critical

time especially when the communication disruption happened in the early stage. We believe that the collection of internet resources integrate with image data is able to help to perform rescue activities as well as the disaster prevention.

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