Creating a tsunami disaster archive of the Great Northeastern Japan earthquake using images uploaded to the internet

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Abstract. We think that the that the experiences from the disaster caused by the Great Northeastern Earthquake in Japan must be of great interest to people not only in the stricken areas but in the whole of Japan and the whole world. Accordingly, we tried to create a method to preserve the digital images of Great Northeastern Earthquake for the next generation. The Creative Commons License may be one of the most useful solutions to avoid complicated processes when a person other than authors would like to build a disaster archive using images uploaded to the Internet.

1. Purpose of this Study

1.1. Earthquake disaster information

Immediately after a disaster like Great Northeastern Japan Earthquake, the people in the disaster area were forced to concentrate on survival, both for themselves and their neighbors. It seemed to be very important how to find transportation.

Even after the situation settled down to some extent, people began to consider, for example, how to share their experiences from the disaster with the next generation, and how to utilize these experiences for future disaster prevention. We think that the disaster experiences like this must be of great interest to people not only in stricken areas but in the whole of Japan and the whole world.

So we tried to create a method to preserve digital images from the disaster for the next generation.

1.2. Upgrading internet public images to geospatial data

Although the images provided by the media like TV stations were also useful, as for Great Northeastern Earthquake, the images uploaded to the Internet were often the information that we really wanted. However, images uploaded to the Internet usually have no exact geospatial attributes. Especially, they have no route information at all. This means they do not have much value as geospatial data.

Accordingly, in this study, we added routing data to the Internet uploaded images, in order to upgrade them for use as geospatial data. Finally, we accumulated the data in order to build a Tsunami disaster archive of Great Northeast Japan Earthquake. Especially we looked for images from the area around the main roads, because we considered that most people have interest in road information. We will be able to make use of it for the disaster education of both children and adults, hopefully to prevent a future tsunami disaster.

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2. Method of this study

We will describe the second stage (current) system comparing with the first system.

2.1. Method of the first stage system

2.1.1. Research area. Research area was the area of Tatehana-koen, Shirogane-machi to Same-machi in Hachinohe-city. All were heavily damaged by the tsunami [Fig 1]. (http://cgi.daily-tohoku.co.jp/cgi-bin/news/2011/03/19/new1103191101.htm) Hachinohe is the second largest city of Aomori prefecture. It is located in the northeast area of the prefecture.

2.1.2. Research materials.

1) Video data taken in the stricken area in Hachinohe
   Video data taken by the author Endo in March 30th, 2011. And the Internet uploaded images distributed by YouTube service with the consent of their authors.
2) Digital map of Hachinohe-city (1/2500)
3) High resolution satellite images
   We bought high resolution satellite images taken before and after the disaster. They contains 4band of 4-meter resolution(R, G, B, Nir) images and panchromatic (monochrome) images of 1-meter resolution. We made pan-sharpened images (color images of 1-meter resolution) by the original images using remote sensing software.

2.1.3. Systems used for this study.

1) The server which serves the content
   Hardware: ordinary PC server assembled by the author Endo
   Software: Linux as an OS, Apache HTTP server as the http server software
2) The client which creates the content
   Hardware: ordinary PC client
   Software: Notepad as an editor, ordinary WWW Browser like FireFox for operating the system
2.2. Method of the second stage system

In the second stage (current) system, we used “Yahoo! JavaScript Map API” which is one of the services available on the Internet. Therefore, the system became sophisticated compared with the first stage system.

(1) Research area
   Same as the first stage.

(2) Research materials
   Video data taken in the stricken area in Hachinohe. Same as the first stage except the digital maps and the satellite images which were not needed to prepare because they were supplied by the Web service.

(3) Systems used for the second stage
   Same as the first stage. But we used the server only to serve HTML files, ASX files and video data for the clients. The functions of the ASX file will be mentioned in the following section.

(4) Web service
   To draw background maps, we used “Yahoo! JavaScriptMap API” one of the services available on the Internet as the developing environment. Accordingly, the programming language is, of course, JavaScript.

3. How to build the archive

By the linkage of video data and high-resolution satellite images which were taken in the target Tsunami disaster area with the digital map of the area, we made an archive system by which we can browse for images from the disaster clearly and easily.

3.1. How to specify the exact route of the video movie?

As mentioned before, images uploaded to the Internet often have no exact geospatial attributes and no exact route attributes. Therefore, at first, we specified the starting point, midpoints, and the ending point of the video movie file.

We watched the video movie and the map near the location of where the video was taken simultaneously. The routes of video movie taking were specified based upon the sign of buildings and roads, and so on. We recorded the route information as one of the geospatial attributes. This sample is the route of the video which was taken around Shirogane-machi in Hachinohe-city [Fig 2]. When we point each node with a mouse, the number of the node will appear at the bottom of the map.

3.2. Making linkage from each node to the video scene [Fig2] [Fig3]

We measured the time from the starting node to the each node. And we made ASX files to
play the video between two nodes (beginning node to ending node) by click the beginning node. We used the clickable map function of ordinary HTML documentation language to make linkages between map images and ASX files. While, we used the function of "Yahoo! JavaScript Map API" to make the linkages between map images and ASX files.

3.3. What is the ASX files?
ASX file is a kind of Windows meta files. This makes it possible to make linkages between web pages and content of WMA (Windows Media Audio) servers or Web servers. By using it, we can control the playback of WMV (Windows Media Video) files. We can specify the start point of the video by StartTime tag, and we can specify the playback duration time of the video by Duration tag. It makes us possible to set plural playback patterns for one video file. So, we can consider the video which has no geospatial attributes as the one which have geospatial attributes in this study.

3.4. Linkage to the satellite images [Fig 2] [Fig3]
In the first stage system, at first, we captured the satellite images around the nodes, and we made linkages from the nodes to the captured satellite images. It makes us possible to see multiple situations from the disaster from other points of view.

In the second stage (current) system, as the system contains satellite images, we do not need to prepare them.

We arranged the JavaScript application to change the map scene to the satellite image scene by clicking a tool icon placed at the upper right corner of the background map.

3.5. The view of calender
We made a calender view as a linkage to the maps for users’ convenience. By using this view, the users can browse this system smoothly and easily.

3.6. Building the Tsunami disaster archive
Accumulating the content as mentioned before, we build the Tsunami disaster archive. We would use MySQL, a linux RDBMS (Relational Database Management System), if we would prepare too much content to browse from the simple HTML files.

**Figure 3. Video Route Map of Second Stage System (Shirogane-machi in Hachinohe-city)**

4. The third stage system [Fig4]
We showed first stage system to the students of our university in 2011. After watched disaster movies, many of the students said that they wanted to follow the recovery processes of the tsunami affected area.

So we took some new video movies in the the affected area of Hachinohe-city in May 6, 2013. About 2 years and 2 months after the disaster. We uploaded the new video data to our server and prepare the map to watch them from the calender view like the previous movies.

Now, we can use our system to compare the videos before the disaster with the ones after the disaster at the study situations for our students and others. Our system has upgraded a little to preserve disaster and recovery memories for a long time.
5. Discussion

5.1. Problem of Copyright
In general, we can not edit and reuse video movies uploaded to the Internet without authors’ permission. If an archive system has many data, it may be very complicated to get all authors’ permission. So, if an author permits the edit and the reuse of his video works, the Creative Commons License may be recommended. This is one of the best solutions to avoid complicated processes when a person other than authors would like to build an archive.

5.2. Problem of Map Update
Using the Web service, we could build the Tsunami disaster archive rather easily and economically. Though the Web service system contributed very much for our system, the map update of the Web service will be contrarily rather unfavorable for the 3.11 disaster map. That’s because we need the map layer of 3.11 for our system. If the Web service would keep containing the map layer of 3.11 for a long time, we would appreciate it very much.

Figure 4. Comparison of the video taken in 2011 with the one taken in 2013 (Similar area).
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