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A Web-based Data Visualization System to Present Infectious Disease Surveillance Data

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Abstract

Based on the Japanese infectious disease surveillance scheme, weekly or monthly reports on infectious diseases are collected from all over the country. We have developed a Web-based data visualization system to make the infectious disease surveillance data more comprehensible for medical personnel. The main feature of the system is that it automatically generates Flash animation by using the collected numerical data which visualizes the time series and spatial shift of the case incidents of disease simultaneously on the home page. This system can provide support for medical personnel to grasp the trend of infectious diseases morbidity and to warn them of any impending outbreak of the diseases.

Keywords:

web-based system, infectious diseases, flash animation

Introduction

The Japanese infectious disease surveillance scheme has been established to detect infectious disease outbreak in early stage, to identify the causative viral strains and to rapidly assess related morbidity and mortality. Based on this schemes, information gathered weekly or monthly on infectious diseases are collected from assigned hospitals or clinics and distributed by print or by home page through the Internet. Because the information reported on the home page is usually numerical data or simple graphic chart, it is difficult for medical personnel to grasp the trend of infectious disease morbidity all over the country. To make a scheme function well, it must provide a good representation of the results of the surveillance [1]. We thought that an animated representation of the data would be a useful way to visualize the time series and spatial shifts of the case incidents of disease simultaneously. However, it is time consuming task to generate animation based on the numerical data gathered weekly or monthly. So, we have developed a web-based data visualization system which can automatically generate Flash animations or graphic images and can visualize time series and spatial shifts of case incidents of disease simultaneously according to the numerical data collected on the home page.

Methods

The operating system used is a Windows2000 Server with Apache 2.0 and MySQL 4.1 as the Web server software and the database management system, respectively. PHP4 was used as a server-side script language and Flash Action Script (FAS) was also used to create animation. The hardware in use for the server is an IBM PC compatible computer with Pentium 4 processor, 512MB of RAM, 80 GB hard discs and 100 base-T network interfaces. Figure 1 shows a block diagram of the server computer setup.

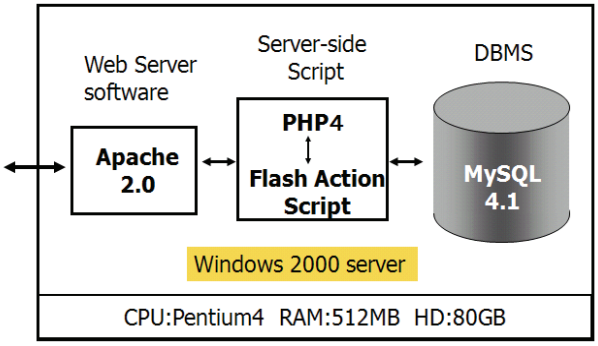

Figure 1 - A block diagram of the server computer setup

The procedure for presenting the animation or graphic image is as follows:

1) the PHP4 server-side script interprets the query keys' input in the request form and retrieves suitable data from the database;
2) the server-side script then passes the data to FAS and FAS automatically generates Flash animation according to the data passed;
3) besides the animation, the PHP4 server-side script automatically generates graphic image file, such as PNG format file, using the data retrieved;
4) Apache sends the Flash animation or image file to the client computer;
5) and the clients' browser displays the animation or image.

A pilot version of this system is usable as a hyperlink at http:// infectsrv2.med.tottori-u.ac.jp/infectious/itis3.html.

Results

At this time, the information stored in the database system is 1) data related to 47 prefectures in Japan and 2) 21 administrative medical districts on the island of Hokkaido, the largest prefecture in Japan located off the northernmost tip of the main island. In case 1), epidemic parotitis data from January 1990 to October 2006 was collected and reflects about 80,000 cases. Case 2) represents epidemic parotitis and measles data collected from January 1990 to February 2007 and reflects about 18,000 cases. This system can present the following three kinds of animation or graphic image:

1) Flash animation simultaneously showing geographical and progressive changes in morbidity throughout the country (Fig. 2): as soon as the start button is clicked, the animation starts and each prefecture is classified into five color coded levels, showing the intensity of the epidemic, which change accordingly as the time progress;
2) A three dimensional bar chart showing annual weekly series rates of occurrence in each prefecture (Fig. 3): The x-axis and y-axis reveal annual weekly periods (1 year is shown as 52 weeks) and rates of occurrence in each prefecture, respectively;
3) A map chart showing the morbidity of any arbitrary 4 consecutive weeks in Hokkaido (Fig. 4): the map shows the intensity of the epidemic of each 21 administrative medical districts by color coding.

Discussion

To make the surveillance scheme function well, it is important to provide a good representation of the data collected in compliance with users' requests. It has also been mentioned that two kinds of output are useful for monitoring the morbidity of epidemic disease: time series of incidents of cases and spatial spread of infectious disease incidents [2]. Our system can visualize time series and spatial shifts of the case incidents of disease simultaneously as images or animations on the home page. Because the animation generated is in Flash movie format, almost any browser can show it. The system can provide support for medical personnel to quickly grasp the trend of infectious diseases morbidity and to warn the general population of any impending outbreak of diseases. We believe this makes infectious disease surveillance data more easily comprehensible for medical personnel.

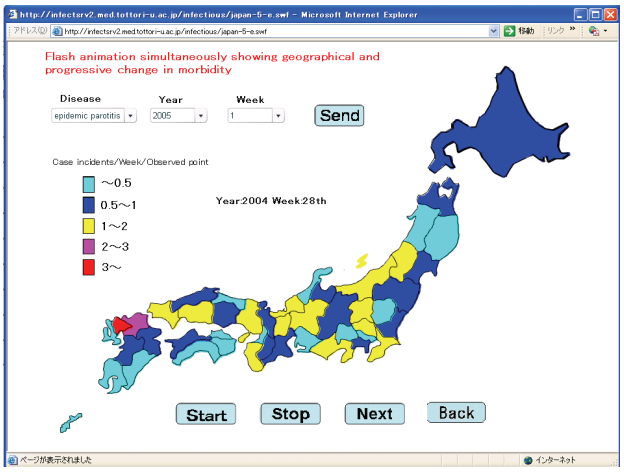

Figure 2 - Flash animation simultaneously showing geographical and progressive changes in morbidity

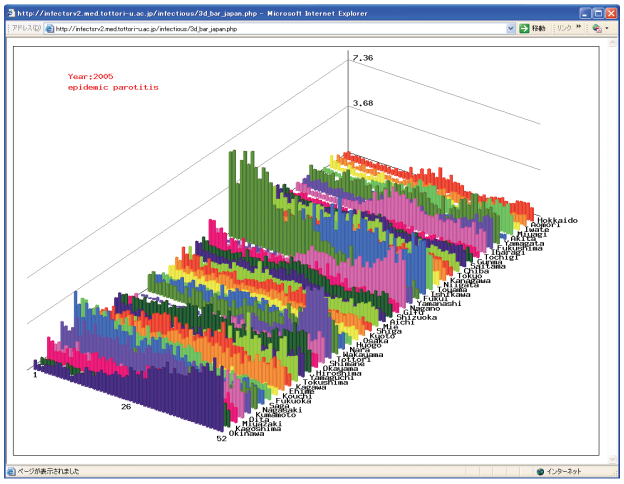

Figure 3 - A three dimensional bar chart showing annual weekly series rates of occurrence in each prefecture

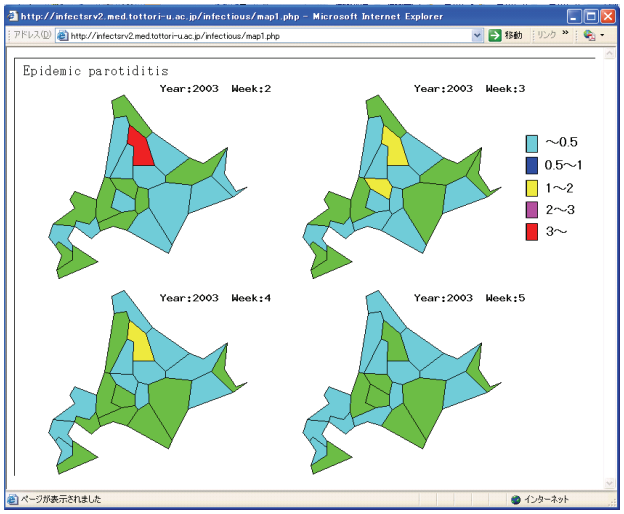

Figure 4 - A map chart showing the morbidity of any arbitrary 4 consecutive weeks in Hokkaido

References

[1] Carrat F, Flahault A, Boussard E, Farran N, Dangoumau L, and Valleron AJ. Surveillance of influenza-like illness in France, J Epidemiol Community Health 52 (1998) 32s-38s.

[2] Boussard E, Flanhault A, Vibert JF, and Valleron AJ. French communicable disease surveillance on the world wide web, BMJ 313 (1996) 1381-1382.