

A Computer System to Retrieve Forensic Medical Data Using the Internet

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A database system was designed, created and tested which enables users to easily retrieve forensic medical information, such as autopsy reports. The system was designed utilizing the World Wide Web, which at present is the most popular application for accessing the Internet. The hardware of this system consisted of two main parts: a server computer providing the service and a client computer requesting the service. Information could be accessed at any time by client machines that were Internet subscribers. The ease of “point and click” searching for terms of interest was a particular benefit of this system. The other advantage of this system was that graphic images could also be obtained. Graphic images can be very useful for forensic scientists. For example, the ability to display images of organs promotes the understanding of autopsies. It was found that the Internet was a very useful tool for forensic research.

Key words: computer system; database; forensic medicine; Internet

The Japanese Annual of Forensic Cases which records autopsies and medical judgments is a valuable reference for forensic scientists to formulate their opinions. However, it is difficult to find specific items among many cases contained in the records. For this reason the Annual has not yet become as useful as it was intended. Some attempts to create a computerized database of forensic cases have been made. Ohno and colleagues (1986) constructed a database on the main frame computer at Tohoku University. Their database was designed to be accessed through the N1 network. The N1 network is a computer network that universities share. The benefit of this system was that it could be easily accessed by anyone who subscribed to the network. Thus, by having a database that was easily accessible, local and distant users could equally benefit. The problem with the N1 network was that it had problems handling the traditional Japanese writing system known as Chinese characters (kanji). Kanji characters were often lost or changed during transmission from the main frame via the N1 network to the local user. To

solve this problem the English alphabet was used to write in Japanese; however, this was not a satisfactory method of overcoming this language problem that computers had at that time. The operation of the main frame computer was also rather difficult and thus the N1 network did not become widely used. For these reasons their system did not become popular.

Technological progress has been made so that now the performance of networks has improved markedly. Most academic institutions in Japan now access the Internet. We have carried out a study of a database system of forensic cases using the Internet. In this study, we examined the usefulness of the Internet for forensic medicine. To do this, we installed primary forensic data into a database and then made this data available via the Internet.

Cases and Systems

One hundred and twenty autopsy cases from 1992 to 1995 from our department were chosen as the resource data. Besides this data we also

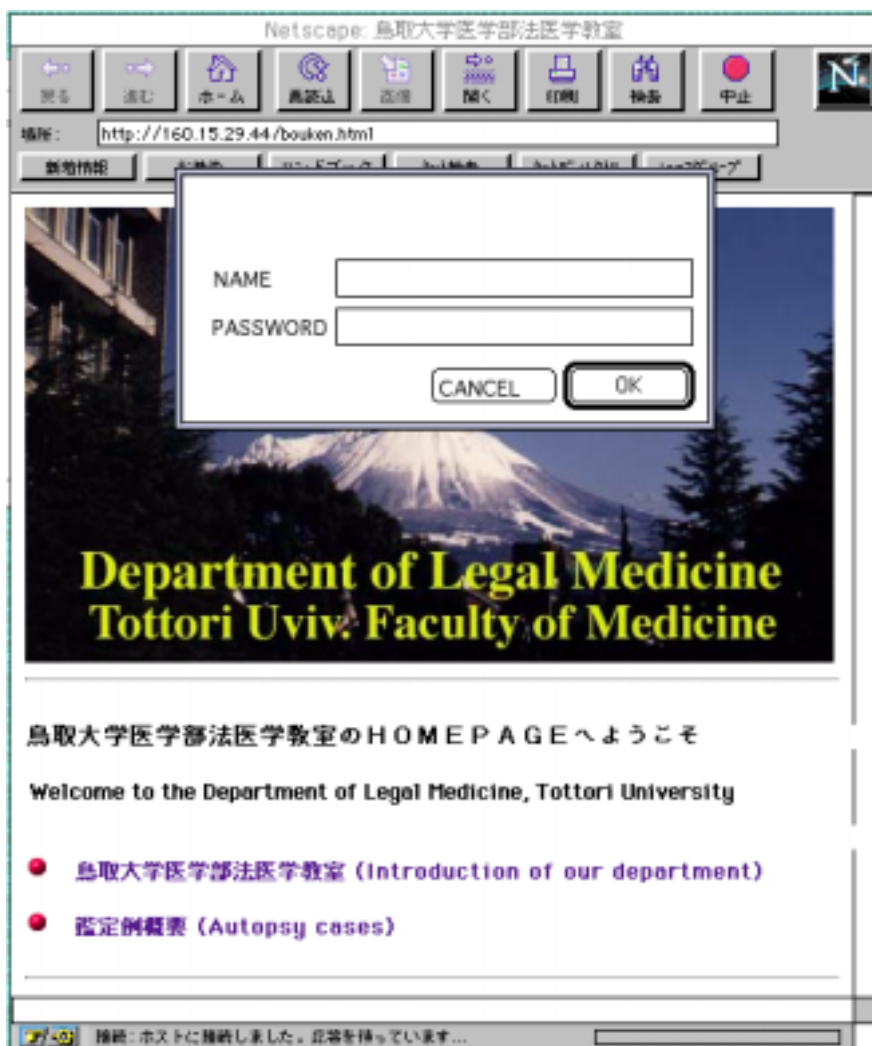


Fig. 1. A window requesting the user's ID and password. Autopsy case files were designed to be secure from free access. When the paragraph "Autopsy cases" on the Home page is "clicked on" this window appears.

made available information about our department. The format of documents of the autopsy cases followed that of the Japanese Annual of Forensic Cases.

The method to retrieve the information was designed to use the World Wide Web (WWW). The WWW, which was developed at CERN in Geneva, is a global information system which is based on the Internet. Basically, the WWW system consists of two main parts: one is a server computer providing the service and the others are the client machines using the service.

To establish a Power Mac 7100 (Apple Computer, Cupertino, CA) as a server computer, which was located at the Department of Legal Medicine, Tottori University, the MacHTTP program (Biap Systems, Houston, TX) was installed. Information was arranged according to the MacHTTP program and was stored on the hard disk of the computer. A second Power Mac 7100, which was used as the client computer, was installed with the Netscape Navigator program (Netscape Communications, Mountain View, CA).

The WWW system, and its easy mouse operation enabled users to efficiently find information available from the server computer. Text in Japanese could be displayed with kanji, and graphic images also could be viewed as easily as text. The introduction of our department had open access; but, the actual autopsy cases needed to be restricted from non-authorized access. Therefore, we needed to design the system so that improper access could be prevented.

System Operations

When the link between the client and server is established, a first page or, "Home Page" is displayed on the clients monitor. This page is a gateway to the server and shows the table of contents. Highlighted words on the page signify where to "click" to see more detailed infor-

mation. When a highlighted word is "clicked on" the link becomes active and provides information related to that word. The services Home Page contained two highlighted paragraphs. When the paragraph "Introduction" was "clicked on" introductory text was displayed. Then, if the second choice "Autopsy cases" was selected a security window appeared. In our system, access was permitted to all. However, the actual autopsy case files were designed to be secured from free access. When the paragraph "Autopsy cases" was "clicked on", a window (Fig. 1) requesting the user's ID and password appeared. The server has registered sets of user identification numbers and passwords for users who were permitted to access the restricted documents. When both the user's ID and password matched those with registered users, access could be permitted (Fig. 2).

The advantage of a computerized database is that it is very easy to quickly find terms which

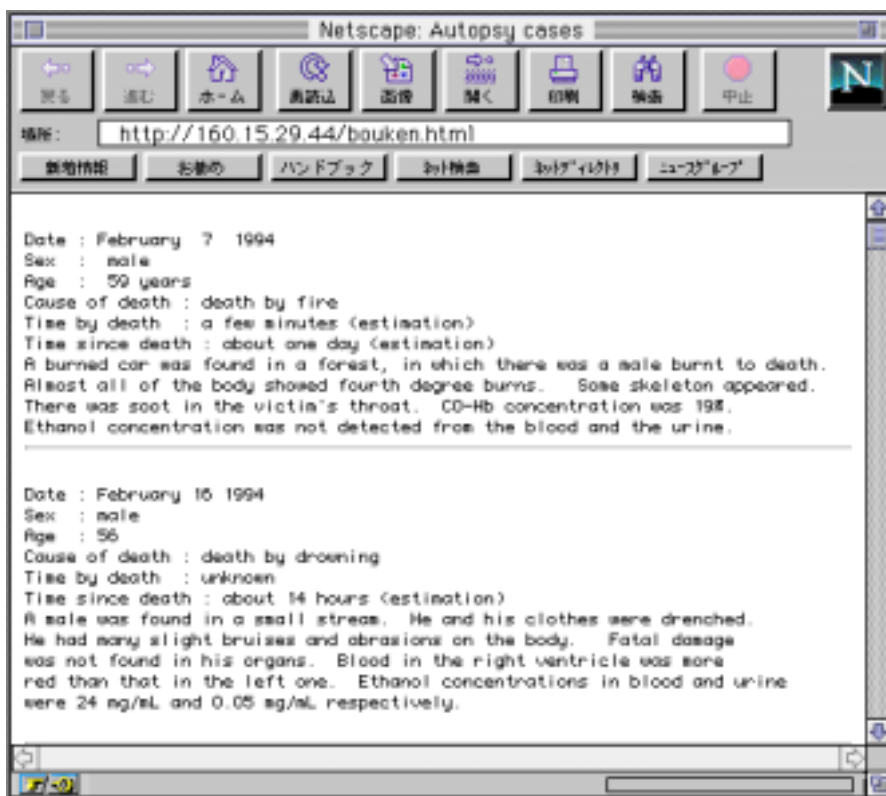


Fig. 2. Documents of the autopsy cases. Only users who are permitted to access can get the data.

are sought. The WWW's advantage is in providing this efficient retrieval. When the "Find" field is clicked on a window appears that requests key words. One can then type any term as a key word to see where it exists in the data. WWW searches for the term in the data. If a match is found the case where the term exists is displayed.

One of the specialities of the WWW is that images can also be easily displayed. When the results of examinations are explained such as autopsy cases or skeletal remains, showing texts and images is effective in promoting understanding. Figures 3 and 4 give an example of such cases. Figure 3 explains the results of an examination of a skull in which the term "suture" is shown as a highlighted word. In this case the highlighted word is linked with an image of the skull clearly showing a suture (Fig. 4). This enabled users to understand precisely what the term meant.

Discussion

During the 1980's computers became more widely used. Several researchers (Kajiwara at

al., 1984; Ohno et al., 1986; Suzuki et al., 1986; Yamamoto et al., 1987) designed forensic medical databases. Ohno and colleagues (1986) and Yamamoto and others (1987) made databases formatted to the criteria of the Japanese Annual of Forensic Cases. Yamamoto and others used a stand alone personal computer which could be used by only local users. Ohno and others constructed their version in a main frame computer connected with the N1 network which allowed remote access. Though both approaches were very different, they both seemed to raise the usefulness of the Annual. Both approaches had merits and demerits respectively. Here we consider features of both approaches. The advantages of Yamamoto's system were that a system can be created based on a user's own criteria and that the user could use it without any restrictions imposed by a server. A drawback was that the addition and/or changes of data had to be performed individually for each computer; thus, updating many computer was a time consuming task. Moreover, if each computer was updated at a different time, the risk arose that some users would get different data at the same time. In Ohno's method the data only had to be changed in the server. Centralization of

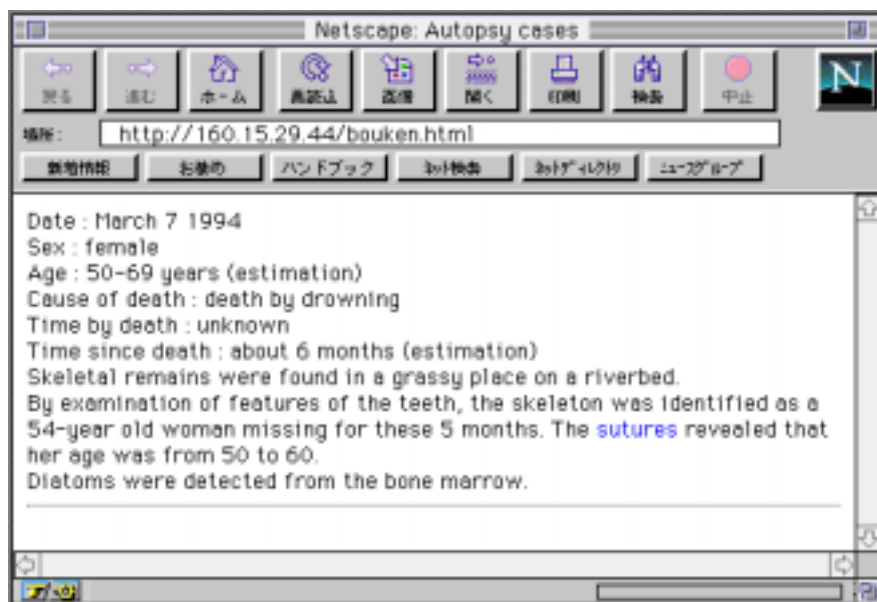


Fig. 3. This text explains the results of an examination of a skull in which the term "suture" is shown as a highlighted word. The word is linked with an image of skull.

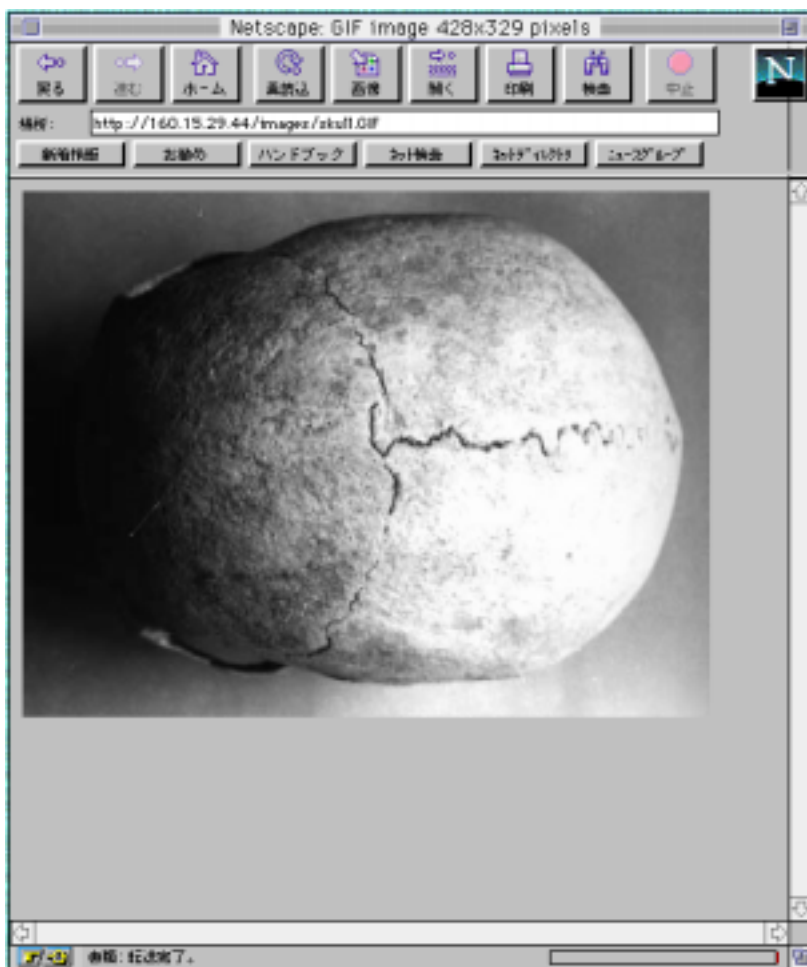


Fig. 4. An image of the skull clearly showing a suture. When the term “suture” is “clicked on” this image is shown.

the data on a networked system eliminates the risk of inconsistently distributed information. There was an insignificant loss of access time when the server was updated.

Every year 4500 cases must be added to the Annual of Forensic cases. If the database of the Annual is created that relies on the use of a stand alone computer, it seems apparent that updating the system is cumbersome and very inefficient. All individual machines would have to store the entire database which would be a redundant waste of memory when the data could be entirely stored in one central host machine. For this reason a network system is the optimum method for structuring the forensic database.

The Internet does not have the problem that the N1 network has; for it can handle the Kanji. Basically the Internet can transfer the Kanji between any computer. User-friendly operation of the WWW mostly involves mouse clicks or occasionally typing a few words, which enables a beginner to easily find information. Users need not be conscious of the distances between the server and the client. Even when using a local server, users can get responses as quickly as if the server was remotely located.

The availability of the data via the Internet offers many possibilities for medical research (Glowniak, and Bushway, 1994). The WWW is now recognized as a useful communication tool

because it is user-friendly and can integrate text, images and sound. Already, there are services available through the WWW (Metcalf et al., 1994). For example, there is an image database system for biologists (Appel et al., 1994) and for radiologists (Reuben et al., 1995). In the field of forensic medicine, the ability to show images as well as text is very useful for understanding cases.

The WWW runs in cooperation with a server machine and a client machine. We used two Power Mac 7100's: one as a server and one as a client. Most computers can be used as servers or clients, for example UNIX, Windows and Macintosh type computers. Many kinds of software are also available for a variety of machines. This makes it easy for a designer to create a server and a client system.

Security is also very important in designing a networked database, especially the security of forensic autopsy cases. Autopsy reports are restricted to those who have authorization. To secure the closed data against misuse, we restricted certain fields of the database through the use of identification numbers and passwords. Users who want to access the restricted data must apply in advance for authorization to the system administrator. Until the administrator registers the user's ID and password, users can not access the data. As long as the user's ID and passwords are not misused the system is secure.

In this study where we tested an Internet utilized forensic database it was found that the WWW was a useful tool for the forensic researcher. The user-friendly operation of the system enables people with very basic computer

skills to easily retrieve data, text and images. By using the WWW it seems possible to construct a database following the format of the Japanese Annual of Forensic Cases. However, before doing this, we have to examine carefully what information will be made available and which users will have partial or complete access, in accordance with the Medico-Legal Society of Japan.

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