The Development of Forest Fire Statistical Management System using Web GIS Technology

Myung-Hee Jo[1] · Joon-Bum Kim[2] · Hyun-Sik Kim[3] · Yun-Won Jo[1]

[1]Dept. of Urban Information & Cadastral Engineering, Kyungil University, Korea

mhjo@bear.kyungil.ac.kr · chogerry@yahoo.com

[2] Korea Forest Research Institute, Korea

JBKIM99@foa.go.kr

[3]Korea Forest Service, Korea

khs0715@foa.go.kr

Abstract

In this paper forest fire statistical information management system is constructed on web environment using web based GIS(Geographic Information System) technology. Though this system, general users can easily access forest fire statistical information and obtain them in visual method such as maps, graphs, and text if they have web browsers. Moreover, officials related to forest fire can easily control and manage all information in domestic by accessing input interface, retrieval interface, and out interface.

In order to implement this system, IIS 5.0 of Microsoft is used as web server and Oracle 8i and ASP(Active Server Page) are used for database construction and dynamic web page operation, respectively. Also, Arc IMS of ESRI is used to serve map data using Java and HTML as system development language.

Through this system, general users can obtain the whole information related to forest fire visually in real time also recognize forest fire prevention. In addition, Forest officials can manage the domestic forest resource and control forest fire dangerous area efficiently and scientifically by analyzing and retrieving huge forest data through this system. So, they can save their manpower, time and cost to collect and manage data.

Ⅰ. Introduction

Recently in order to manage the overall forest fire statistical information in efficiently and promptly, the implementation of forest fire statistical information management system and construction of infrastructure related to it are deadly needed especially after a large scale of forest fire was occurred along the east coast.

For this, long term forest fire statistical information from a national point of view should be constructed in database. Especially, the various querying and spatial analyzing the certain data, spread in spatial space such as forest fire, still left as final problems.

In this paper to solve and perform these above problems efficiently in distributed network environment and serve in real time, Web based GIS(Geographic Information System) is considered as up-to-date spatial information technology.

Therefore, general users can obtain the whole information related to forest fire visually in real time also recognize forest fire prevention. In addition, the practical affairs related to forest fire can work with it to support their policy and have opportunities to stand on the basis for scientific and synthetic forest fire management through rapid input, various retrieval and visual output. Finally, in case of formulating a policy to prevent against forest fire and protect forest, this system can play a role as main decision making supporting system.

Ⅱ. The Construction of Forest Fire Statistical Information Management System

Fig. 1 shows the entire structure of forest fire statistical information management system. In the view of general users they can have service corresponding to their retrieval in format of text, graph, map while in the view of officials related to forest fire they first have access authority to database then inputs data. Also, they can retrieval not only published information but also unpublished information and output them in various visual contents format (text, graph, and map) and file format (.xls and .txt).

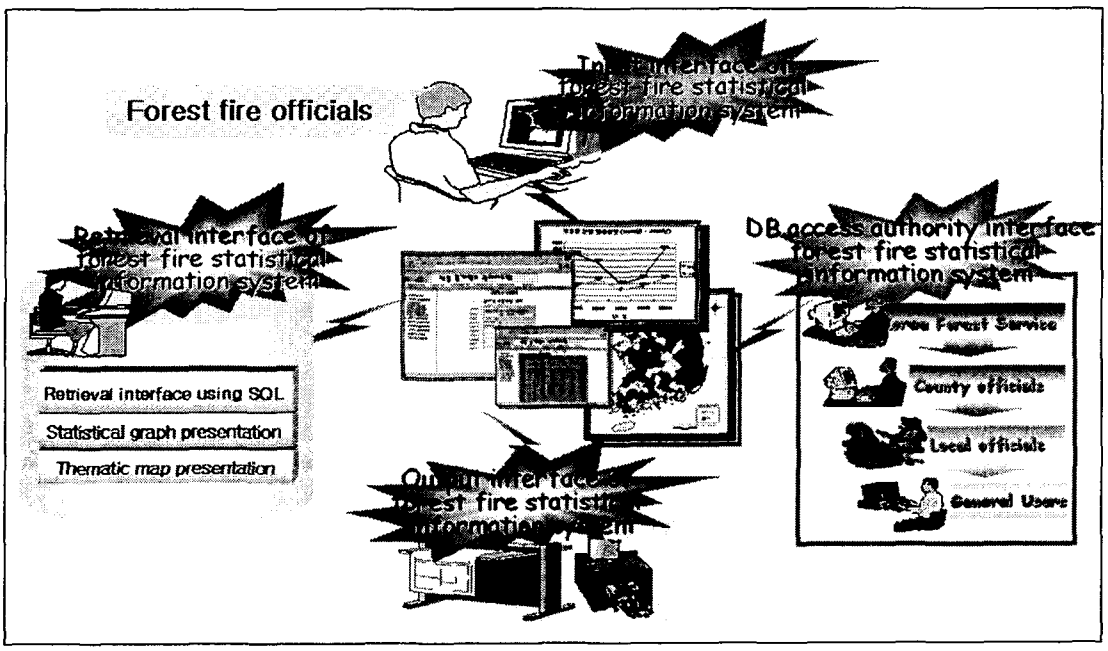


Fig. 1 The structure of web based forest fire statistical information management system

1. The construction of GIS DB for forest fire statistical information management system

Before taking up the main subject, to manage the whole data for the system efficiently and synthetically the structure of entire tables existing in database should be defined. Then the relation and restriction among them have to be prepared.

To operate this system and serve sufficient information toward users, there exist 26 tables and administrative map in database. Among 26 tables, some tables include fundamental data to operate database itself such as forest fire, meteorology, and system access authority while others include additional data such as helicopters sates for extinguish, incendiary and topography. Fig. 2 shows the example of forest fire table and the fundamental layer to present the result of statistical processing.

TB_ForestFire

칼 A	NULL	형	비
id	NOT NULL	NUMBER(10)	일 련
y_number	NOT NULL	VARCHAR2(5)	년 A
m_number	NOT NULL	VARCHAR2(5)	월 A
s_date	NOT NULL	DATE	발 생
f_date	NOT NULL	DATE	진 화
country	NOT NULL	VARCHAR2(10)	관 A
metropolis	NOT NULL	VARCHAR2(10)	시 A
county	NOT NULL	VARCHAR2(10)	시 A
town	NOT NULL	VARCHAR2(10)	읍 A
dong		VARCHAR2(20)	동 A
parcel		VARCHAR2(30)	지
m_name		VARCHAR2(20)	산 A
division	NOT NULL	VARCHAR2(10)	소 유
d_cause	NOT NULL	VARCHAR2(10)	발 생
k_cause	NOT NULL	VARCHAR2(50)	세 부
area	NOT NULL	NUMBER(10)	피 해
n_area		NUMBER(10)	국 유 림
j_area		NUMBER(10)	조 림
d_tree	NOT NULL	VARCHAR2(10)	임
k_tree	NOT NULL	VARCHAR2(25)	수
t_number		NUMBER(15)	본
jaejuk		NUMBER(15)	재
sog		NUMBER(15)	량
d_money		NUMBER(15)	피 해
etc_damage		VARCHAR2(100)	기 타
name		VARCHAR2(10)	성
sex		VARCHAR2(10)	성
age		NUMBER(3)	나
address		VARCHAR2(100)	주
d_death		VARCHAR2(10)	사 망
d_cause		VARCHAR2(100)	원
etc		VARCHAR2(100)	비

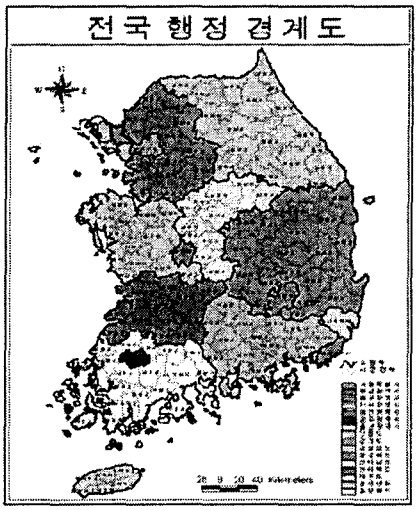


Fig. 2 The example of GIS DB construction for forest fire statistical information management system

2. The Network Construction for Internet Services

As you see in Fig. 3, this system is focused on server operation. Each GIS data processing and spatial analysis are performed on server side then return the result of the processing in image format (.jpg) to minimize data traffic on internet. Every country and local officials to access this system on Internet are granted their ID and password form central government officials of Korea forest service while general users can access to the system without ID.

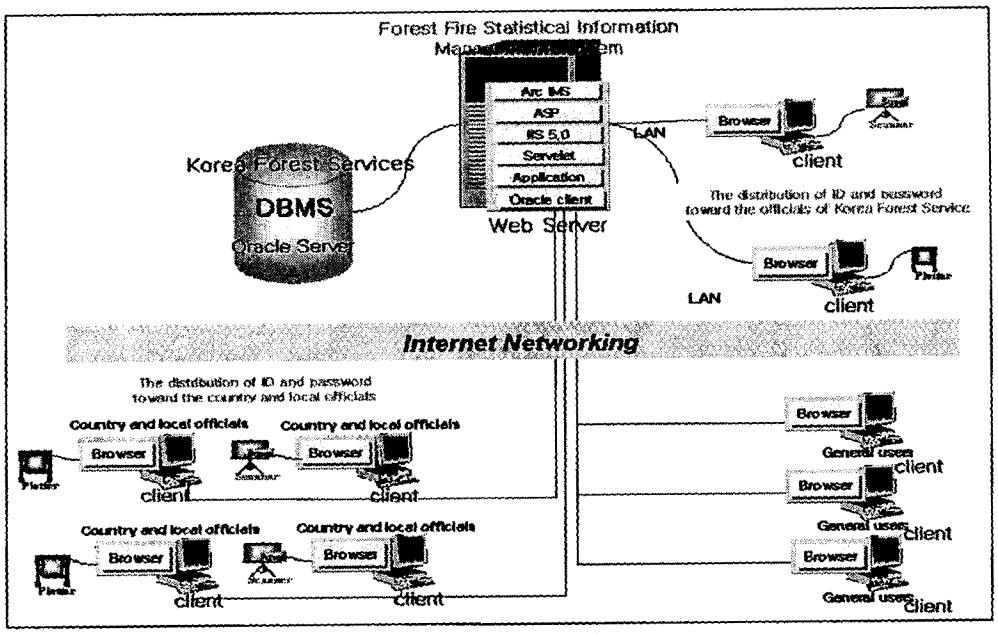


Fig. 3 The network construction for Internet services of the system

3. The implementation of web based forest fire statistical information management system

As you see in Fig. 4, the system structure is consisted of client side, middle ware, server that is corresponding to users, map server, web server, respectively (3-tier). System users obtain their desired result through map server using web browser.

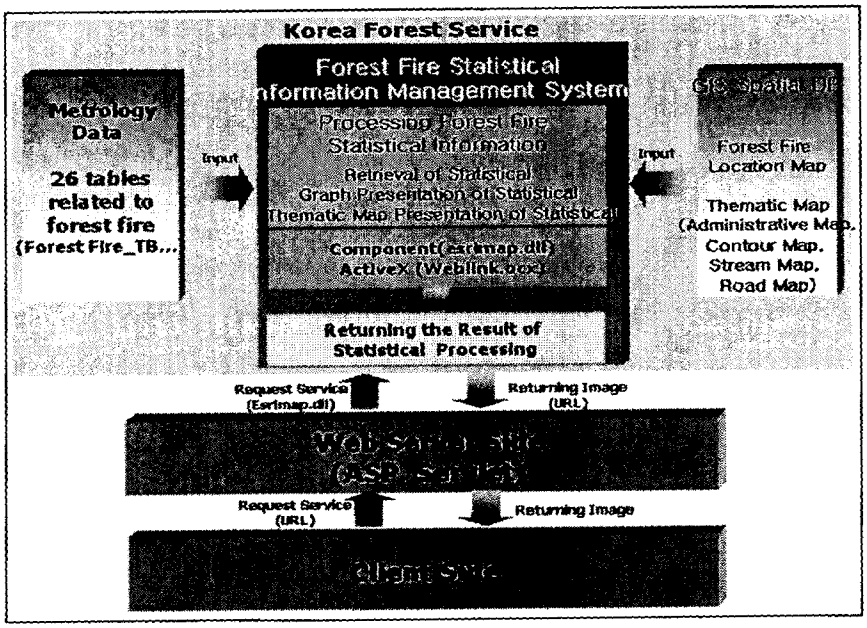


Fig. 4 The flow of message between map server and web server

In this paper the system interface development is focused on API(Application Programming Interface) methodology . To implement this system, IIS 5.0 of Microsoft is used as web server and Oracle 8i and ASP (Active Server Page) are used for database construction and dynamic web page operation, respectively. Also, Arc IMS of ESRI is used to serve map data using Java and HTML as system development language. This system has tree big interfaces, which works as input interface, retrieval interface, output interface, DB access authority interface. Fig. 5 shows the main interface.

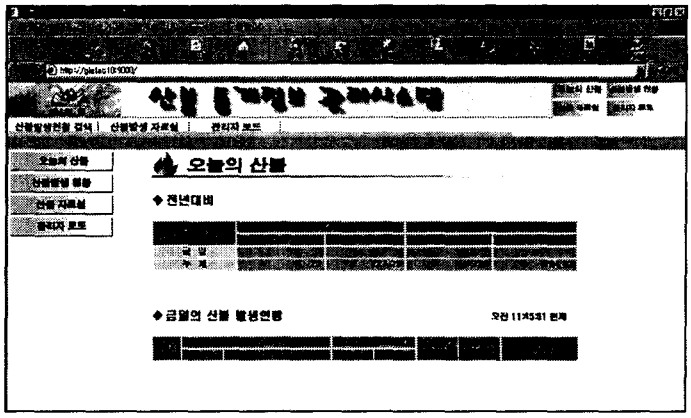


Fig. 5 The main interface

■ Input interface implementation

Previous forest fire data is stored and managed in format of .xls so that the complicated various retrieval and spatial analysis cannot be performed. However, in this system the input interface is implemented as user-friendly interface and connected to DBMS.

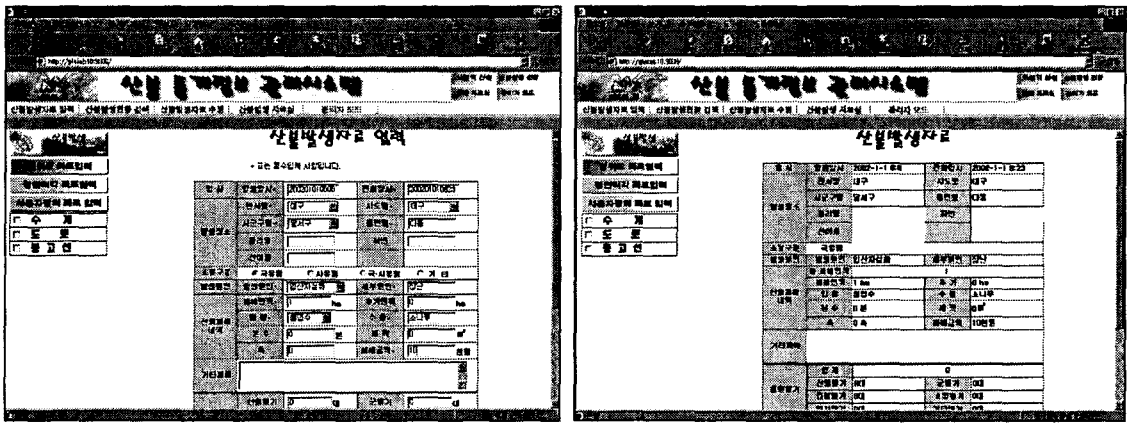
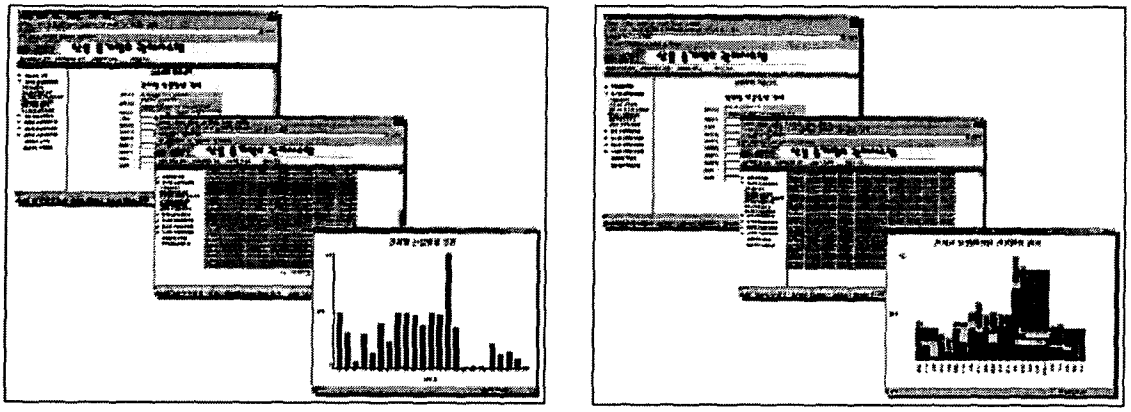


Fig. 6 Input interface implementation

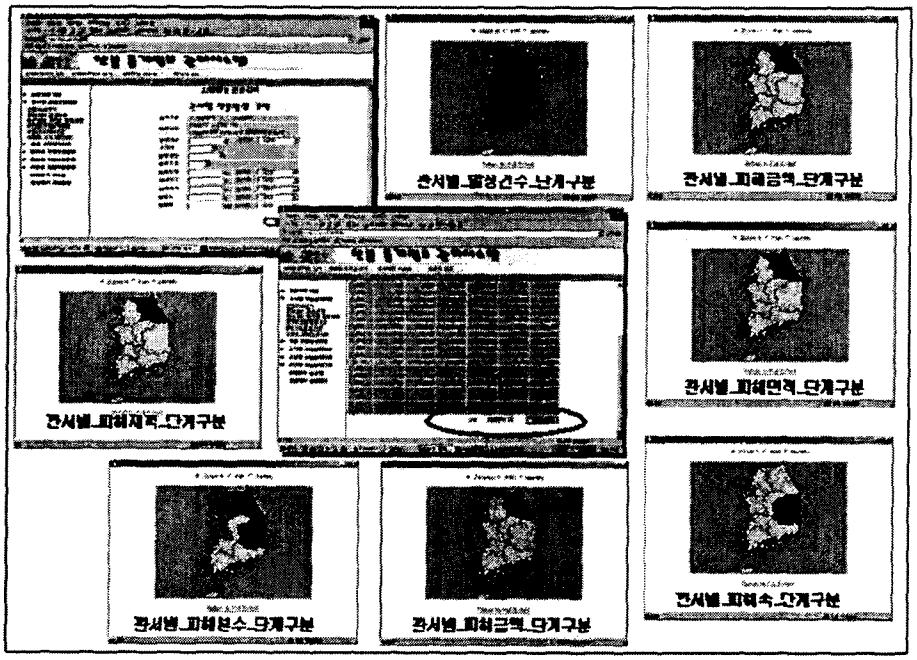
■ The retrieval interface implementation

In this system anyone, who doesn't have any knowledge of SQL, can operate query

through user-friendly interface. Also, the result of statistical retrieve can present in format of text, graph, and distribution map. Therefore, it helps users understand the tendency of domestic forest fire more easily.



(a) The result of retrieval (text, graph)



(b) The result of retrieval (map)

Fig. 7 The retrieval interface

■ The output interface implementation

In case of officials make presentations of report using forest fire statistical data, this interface can support two output format (.xls, and .txt). Therefore, users can put their retrieval result to their desired report document format.

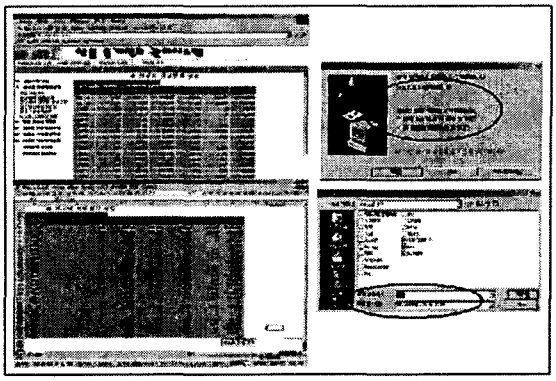
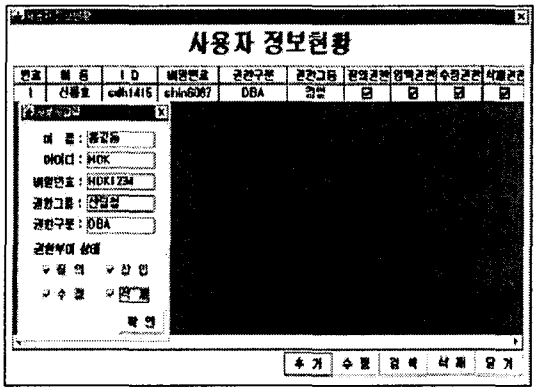
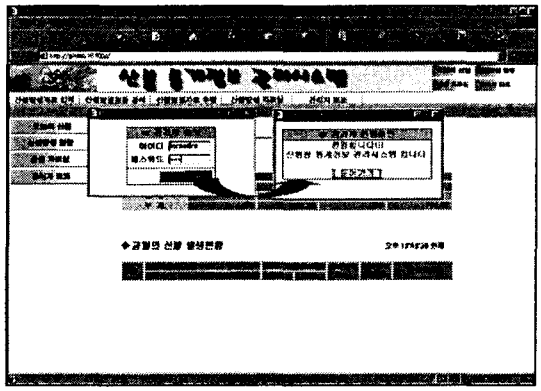


Fig. 8 The output interface

■ User authority management interface implementation

This interface classify and manage user authority such as government official, country officials, local officials, and general users so that it control the opportunity of access to main database and keep the security of data. Through this interface, desired officials can access to database and input and retrieval and output about whole data in database while general users cannot.





(a) Defining User authority (b) Management official mode

Fig. 9 User authority management interface

Ⅲ. Conclusion

In this paper forest fire statistical information management system is constructed to present domestic forest fire status and tendency using web GIS technology and spatial information technology. Following description indicates the effect of our study briefly.

■ This system plays a role as decision-making supporting system for domestic forest fire policy through not only accessing the whole previous forest fire status data constructed using GIS but also retrieving

and analyzing places where has weigh score of forest fire.

- Forest officials can manage the domestic forest resource and control forest fire dangerous area efficiently and scientifically by analyzing and retrieving huge forest data through this system. So, they can save their manpower, time and cost to collect and manage data.
- General user can share their opinions through Internet about domestic forest fire policy and reflect them to the service contents. Also, these all motivation can be constructed as the foundation of domestic infrastructure for forest fire policy.

Reference

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