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GIS를 이용한 신고자 위치표시 시스템 개발

GIS Application for 1-1-9 Caller Location Information System

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要 旨

고도화된 현대 산업사회는 대형 건축물과 각종 사회기반 시설물의 밀집화로 예기치 못한 각종 재난과 재해가 늘어나고 있다. 따라서 이러한 재난과 재해에 대한 예방과 예보를 통하여 피해를 최소화하고 신속한 수습과 복구 등을 과학적으로 할 수 있는 능률적인 사고대응 체계의 필요성이 절실한 요구되고 있다. 신고자 위치표시 시스템 개발의 목적은 ANI(자동전화번호식별), GPS(범지구측위시스템)등의 첨단기술을 GIS와 연동하여 신속하게 재난과 재해를 대처하는데 있다. 개발된 시스템으로 신고 즉시 사고 위치와 사고지점까지의 최단거리를 표시 할 수 있어 신속한 수습과 대책이 가능하였다.

Abstract

The main purpose of 1-1-9 Caller Location Information System is to identify and display the precise location of emergency incidents such as natural or man-made fires, medical emergencies and accidents. The state-of-the-art technologies such as ANI (Automatic Number Identification), GIS (Geographical Information System) and GPS (Global Positioning System) were applied and integrated in the system for efficient and effective location identification. It displays a radius of 25M, 50M and 100M on the map after location identification.

The system can also provide the shortest path to an incident location from a fire station or a fire engine. In case of a fire breakout in or near a building, the attribute information of the building, called a building attribute card, is displayed along with the map location. The system then matches the information with the fire situation and sends an alert to a responsible fire station by phone or fax in order to help promptly react to the problem. An attribute card includes the critical information of a premise such as building's location, number of stories, floor plans, capacity, construction history, indoor fire detection and prevention facilities, etc.

1. Introduction

The area of Seoul, the capital city of Republic of Korea, as of the end of 1998 is 605.52 ㎢, or 0.6% of the entire country. Han river bisects the city into two parts, northern and southern Seoul. Northern Seoul totals 297.97㎢ (49.2%) while the southern part is 307.55 ㎢ (50.8%).

Seoul has a population of 10,321,496 individuals and 3,458,511 households as of the end of 1998. This accounts for about a quarter of the total national population. As for proportion of male to female, men (5,173,556) slightly outnumber women(5,147,940). Because of the rapid development of the city in the modern history, the structure and environment of the city is getting complicated and

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there exist ever increasing possibilities of emergency situations, either by natural or man-made disasters.

In order to prevent and rescue the life and properties of the citizens from fire and other disasters, the city's Metropolitan Fire Department has been developing 'Emergency Dispatch and Rescue Information System' by utilizing Enterprise GIS technology from 1996 to the present. The system is expected to complete by the beginning of the year 2000.

2. Project Overview

The EDRIS is an integrated system of call taking, emergency dispatching and operational information management functions. It consists of several subsystems such as '1-1-9 Caller Location Information System', 'Vehicle(fire engine) Tracking System', 'Dispatching System', and 'Fire Facilities Management System'. It can help identify the exact location of emergency incident and can support rescue dispatch through intelligent message broadcasting and the shortest path generation.

One of the critical success factors of the system, as most mission critical systems, is its efficiency. The system must allow fast search of information from massive textual and geographical data and execute multiple queries and reports at almost real time. The design of a consolidated database, which carries both operational information and geographical information, and the functional architecture, supporting for fast retrieval and association of the textual and graphical information, were the challenging design issues.

SDE 3.0.2 and ARC/INFO 7.2.1 on UNIX platform became the fundamental GIS softwares for the system. ORACLE was selected as the RDBMS for its seamless integration with SDE. Visual C++, for is flexibility and integrated development environment, was used for developing client application on Windows NT.

3. System Implementation

3.1 Database

For '1-1-9 Caller Location Information System', the project team needed to construct disaster related database including both spatial and attribute data. Spatial database should contain both general supporting information and operational disaster related information. General information includes roads, buildings, geocode map, administration boundaries, traffic information, and meteorological information. Disaster related information includes hydrants, fire fighting facilities, hazardous material and facilities information, fire station location, hospital information, and disaster controlling unit. For detail information about spatial database, please refer to the following table 1.

3.2 1-1-9 Caller Location Information System

This subsystem provides operators with various convenient query mechanism for location information and displays context sensitive features for rescue unit dispatch to help clear the problem as fast and efficient as possible.

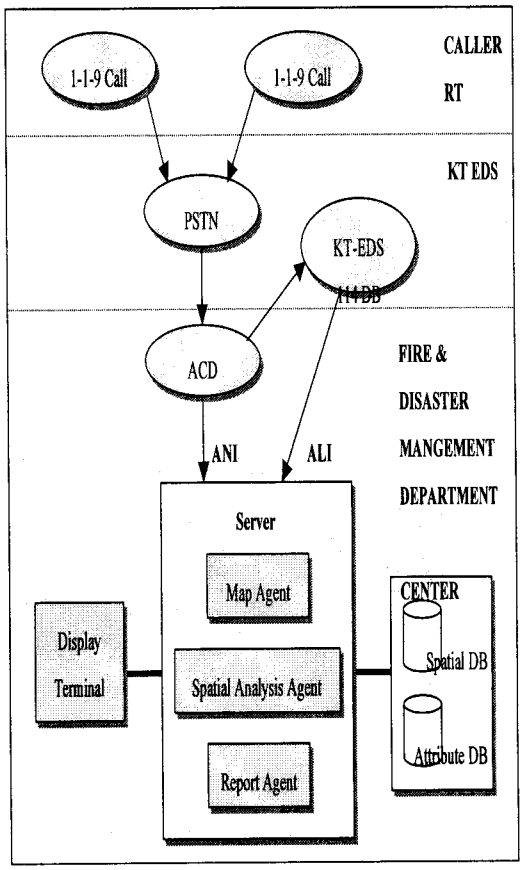
ANI and ALI modules are integrated in the call taking process, as shown in the following diagram. When emergency operator picks up a 1-1-9 call, he

or she can almost simultaneously get a caller location information, neighboring information, a shortest path and an estimated time to destination.

Table 1. Description of Spatial Database

	Data	Description
General Information	Road	Road name, number of lanes, link to other road(s)
	Main Building	Detail information of large and tall buildings specified by a regulation
	Geo Code Map	Geo code with address
	Administration Boundaries	Administrative jurisdiction boundary
	Traffic Information	Location of traffic accident, under construction, etc.
	Meteorological information	Snow, rain, mist, etc.
Disaster Related	Fire Facilities	Fire hydrant, hydrant location, etc.
	Hazardous Facilities	Explosive or volatile facilities
	Fire station Location	Fire station, ward office
	Hospital Information	Hospital location, capacity and specialties
	Disaster Controling Unit	Main body who control the sector
	GPS	Vehicle(fire engine) location, type of vehicle (on-line) information

Fig. 1 1-1-9 Caller Location Information Process Flow



- ANI: Automatic identification of the caller's phone number
- ALI: Automatic identification of the address matched with the phone number
- Map Agent: Agent handling the map display of the location with appropriate zoom scale, pan relocation and symbol(s)
- Report Agent: Agent providing the displayed information with a pre-specified report format

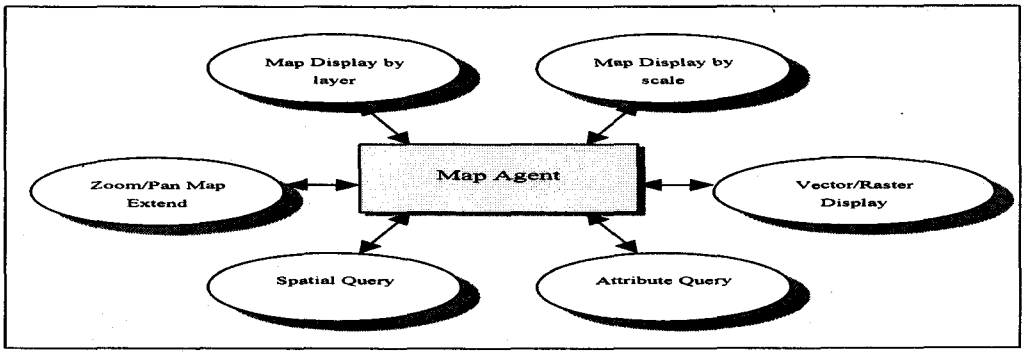


Fig.2 Main Functions of Map Agent

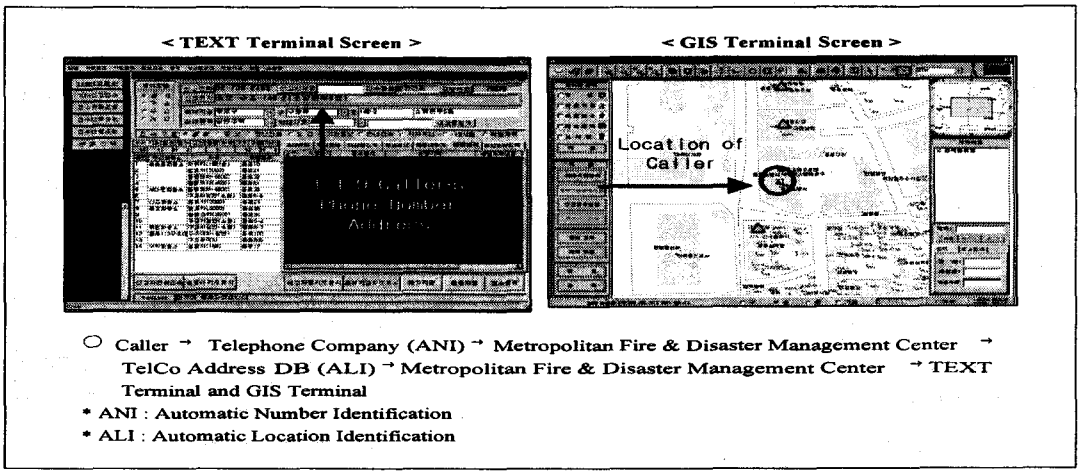
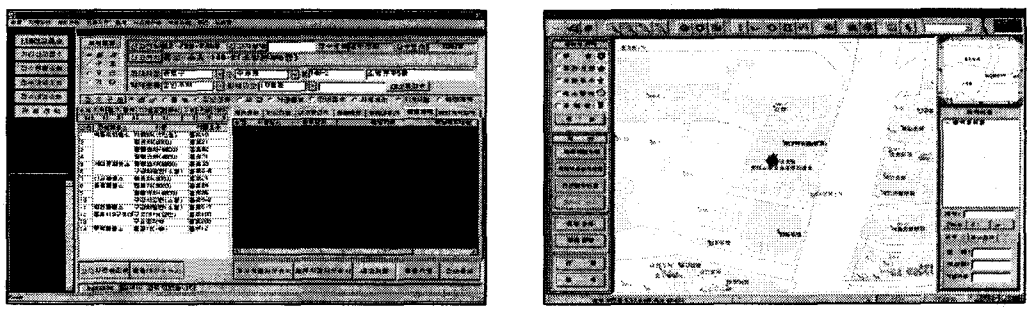


Fig.3 Identifying 1-1-9 Caller's Phone Number and Displaying Map Location

< TEXT Terminal Screen > <GIS Terminal Screen >



○ Key in on TEXT Terminal → Display GIS Terminal Screen automatically
○ Input by mouse-click on GIS Terminal → Display textual information automatically

Fig.4 Identifying and Displaying Disaster Location

3.3 Vehicle Tracking System

This subsystem provides the functions of fire engine operation management system in case of emergency dispatching. GPS technology enables to monitor fire engines movement in on-line mode. 'GPS Agent' receives the location information of fire engines and feeds this information to Map Agent for display.

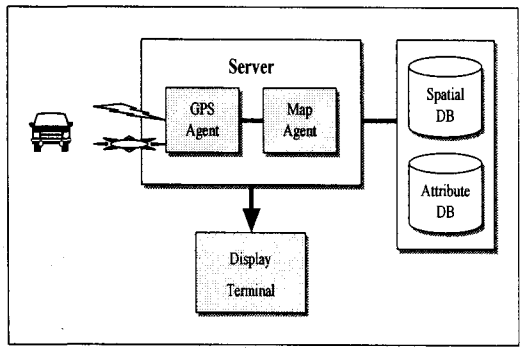


Fig.5 Vehicle Tracking System Diagram

3.4 Message Delivery System (Information Support System)

Information Support System maintains various informations related to disasters and can be operated with Message Delivery System. For example, in case of emergency, this subsystem can verify and display the up-to-date information, and provide essential information for the preparation of message delivery plan. It also performs the function to support decision-making process for message delivery.

* Main Functions

- □ · · · · · Road, building and disaster facilities information display
- □ · · · · · Disaster size and type display
- □ · · · · · Providing the regional disaster facilities information
- □ · · · · · Disaster response plan and display
- □ · · · · · Message delivery by fire station

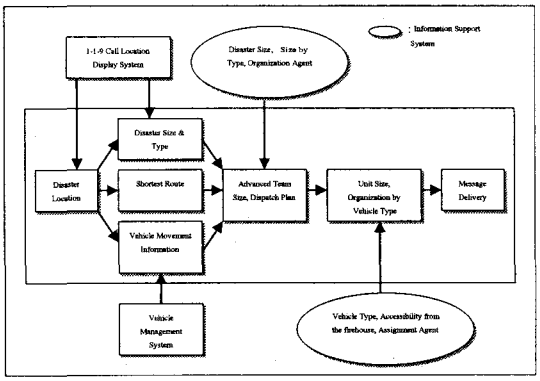


Fig.6 Message Delivery System Diagram

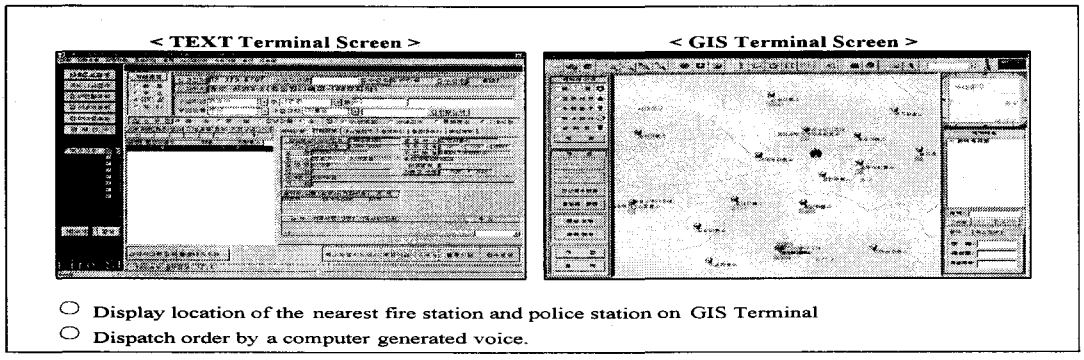
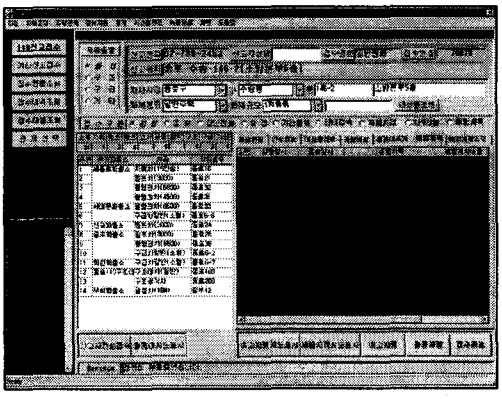
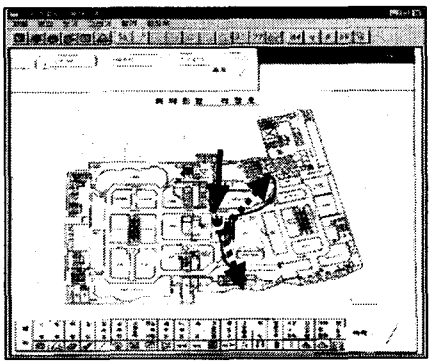


Fig.7 Dispatch Order



○ Keep a Response Plan Chart per Type against Fire
○ Provide GIS related Information on the objects

Fig.8 Automatic Dispatcher Organization



○ Keep a Response Plan Chart per Type against Fire
○ Provide GIS related Information on the objects.

Fig.9 Disaster Response Plan Chart

3.5 Fire Facilities Management System (Map Editing System)

Fire Facilities Management System has the goal in performing the function of disaster management system by maintaining the fire facilities consistently. This system provides information in the aspects of previous FM and future plan by displaying the facilities information with spatial and attribute information. It can also set up plans to cope with disasters using the information of appropriate resources.

Spatial and attribute data of Fire Facilities may be changeable. Therefore, the procedure to create and build data as well as the editing function such as correction and addition for these data are important. It is required to verify data for optimization or errors.

4. Conclusions

During this project, we found some difficulties of finding 1-1-9 Call Location Information because of

1) accuracy problem on parcel based map,
2) discrepancy during integration of various source information,
3) text annotation overlapping.

In order to improve efficiency of this system, we have to study more about

1) moving vehicle tracking system by using GPS,
2) rescue vehicle dispatch arrangement by analyzing temporal disaster occurrence,
3) re-distributing fire hydrant after its position analysis,
4) integration with GIS-T or ITS and improvement of dispatching functions in conjunction with transportation environment.

5. Acknowledgements

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