Development of Cadastral Map Management System Based on the Vector Method

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1. Introduction

Comparing to another affairs, cadastral is based on the general administration. It is already being computed. cadastral computerization must have a high reusing for it is applied without large change in land information system. In case of land utilization confirmation document provided from the office, it spent on time over 30 minutes from application to acquirement. This need to many people and time in processing. Moreover, cadastral is directly related to private property and another problem. The cadastral computerization management is method of solving this problem. Cadastral auto computation is satisfied need of civilian through as it is express master plan of urban development like cadastral boundary line.

1.2 Background

The field of cadastral map management method is studying for practice. And for speciality of cadastral, all nation execute cadastral management proper for themselves. Especially cadastral map computerization is building on related geographic information system.

In nation, cadastral map management is used gauss double projection for length of land and accurate division of area because it is related to boundary lines of land and cadastral ownership. Therefore, we can decide length and area. But we are difficult manage the whole cadastral map because of discord of map connection.

In searching the study of cadastral map computerization in South Korea, it is extending and reduction correction about cadastral map using boundary line[1], the study of auto topography object recognition and modeling for cadastral map application[2], the study of plan and realization of topography object auto extract system for cadastral map[3], the study of digital information of cadastral map[4], the study of cadastral system and computerization at foreign country[5].

Cadastral affair is proceeded from cadastral part of each office and Korea Cadastral Survey Corporation because of operating on South Korea. Now, computerization management of cadastral is operated with raster map data. But as raster map data is used, cadastral map is not correct, and that is difficult connected with geographic information system. For more accurate map management and as a whole management, it must be operated that cadastral map used with vector data.

2. Construct of Cadastral Map Management System

2.1 Current Affair Analyze of Cadastral Map Management

Current affair analyze take precedence over all others for system architecture analyzing and affair understanding, current system problem understanding, requirement searching, system improving. Affair analysis was performed on PusanJin, Suyoung, Yonje, Saha, Haeundae offices that was constructed

cadastral computerization. Affair analysis method was direct visit.

Before the computerization, it is spend to time 40 - 50 minutes for cadastral map acquirement, but after computerization, it is spend to time within 10 minutes and efficiency of affair rose. The most offices have using raster data map, but only Yonje office has using vector data map. Raster data method by scanning has the advantage of the cost reduction but this has the error and this cannot reuse.

if this is changed with vector data, this is added the cost but reusing of data rise and has high efficiency in days to come.

Now, the main affair of cadastral map management system is acquirement of land utilization confirmation document and merge-divide work of cadastral. The management system is to be use for cadastral computerization but the use is low, cadastral data is not reused.

2.2 Vector architecture and Raster architecture

Vector architecture is displayed position of the object in space that it has direction and size. Vector architecture is accurately displayed point, line, surface for expression of object and character an object. Therefore, target a region must have continuous coordinate system. All objects on geography have a shape of point, line, surface and this is displayed on 2-dimension. So, the one point is displayed on one (X, Y) coordinate, the one line is composed more two point (X,Y) coordinate and the surface or polygon is composed more three point (X,Y) coordinate.

At raster architecture, space is divided the grid of fixed size and position of space object is displayed with row or column. Addition, area size of each grid is mean by accuracy of data, if area size of each grid is small then accurate expression is possible, and if area size of each grid is large then summary expression is possible. Table-1 shows advantage and disadvantage between vector and raster architecture.

Table-1. Advantage-Disadvantage of Vector and Raster Structure

Vector Structure
·Advantage - Complex real world description is possible. - More compressed data structure is supplied and reduction of data volume is easy. - Various space analyze is possible like network analysis with information about topology. - The high resolution supports high spatial accuracy. - Extract and renew of attribute information is easy .
· Disadvantage - Complex structure. - The use of better computer, increased management needs, and other considerations often male the vector format more expensive. - Vector formats require more powerful, high-tech machines. Management of computer equipment becomes more of a problem. - Each graphic factor have each different topology structure so that is difficult to analyze.

Raster Structure
·Advantage   - It is a simple data structure   - The simple, coded grid structure makes analysis easier   - Remote sensing imagery is obtained in raster.   - Because the size and form of grid is the same, simulation is easier.
·Disadvantage   - Compressed data structure is supplied so raster systems can have very large data set.   - If grid size is extended then data set can small but cause of data lose.   - The much time is spent for coordinate conversion   - Topology information is not supplied so analysis function can't be done like network analysis.   - Because each cell tends to generalize a landscape, the result is relatively low resolution compared to the vector format. Even the use of a very high number of cell can only guarantee better resolution, not necessarily satisfactory accuracy.

2.3 Cadastral Map Management System of Vector Method

In our laboratory, we developed a vector cadastral map management system which is computerized land utilization confirmation document acquirement affair. It is make vector from cadastral data, so data accuracy is high and reusing is possible. Addition, It can input number of land so land utilization confirmation document acquirement is easy. Before the acquirement, content of acquirement is confirmed by using the preview function. If divide-merge work of field is needed then it can correct at program. Figure-1 shows total development flow chart of cadastral map management system at developed this study.

Work map digitization

Input Vector data map

Input field Database

Work on input part with complete map and database

Work on output part
- First output : display to offered field
- Second output : Output to A4 paper,
                  Output to data of offered field
                  Ouput to 1:200 map of offered field

Figure-1. Total flow chart of cadastral map control system

Figure-2 shows a part of detail flow chart.

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┌─────────────────┐                          ┌──────────────────┐
│   Digitizing    │                          │ TEXT DATA        │
└────────┬────────┘                          │ Design line      │
         │                                   │ Entry data       │
┌────────┴────────┐      ┌──────────────┐    └────────┬─────────┘
│   Arrange map   │──────│  Remove dust │             │
└────────┬────────┘      └──────────────┘             │
         │                                            │
┌────────┴────────┐                                   │
│  Compose layer  │                                   │
└────────┬────────┘                                   │
         │                                            │
┌────────┴────────┐                                   │
│   Register DB   │───────────────────────────────────┘
└─────────────────┘
```
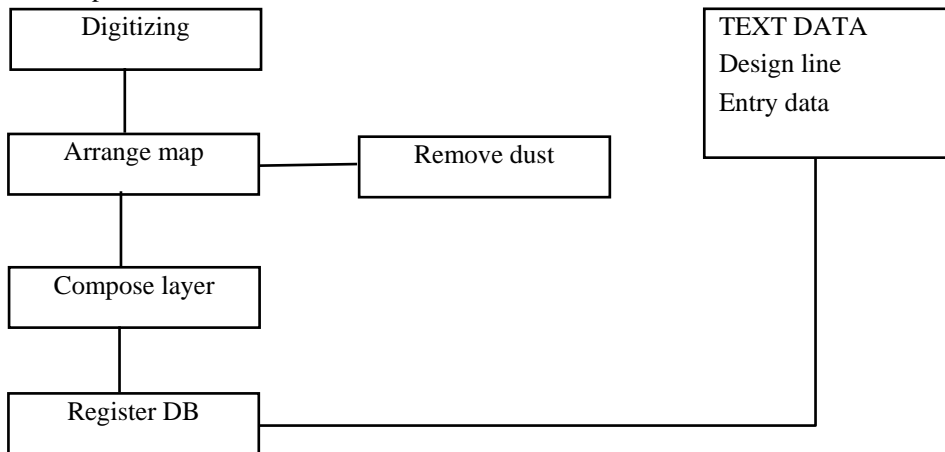
Figure-2. A part of detail flow chart

Construction of database is made with contents of land utilization confirmation document. Table-2 shows contents of cadastral map management system database.

Table-2. Database contents of cadastral map management system

Land utilization confirmation document field name			Issue book field name
Issue number			Issue number
Applicant	Name		Issue date
	Address		Village name
A case region	Land position region	Ward	The number of land
		Village	The classification of land
	The number of land		
	The classification of land		
	Area(m^3)		
Confirmation contents	Land use	Use area	
		Use zone	
		Whether or not development plan setting	
	City plan	Use area	
		Use zone	
		City plan facility	
		City development business	
		Zone	
		Etc	
	Military installations		
	Agricultural land		
	Forest		
	Nature park		
	Water supply		
	Cultural assets		
	Land dealings		
	Etc		
The person in charge			
A telephone inquiry			

In our laboratory, we developed a vector cadastral map management system which is base on vector data. On the whole processing was made with the Visual C++ ver5.0 compiler of Microsoft, database construction was made with the Access97 of Microsoft. Addition, construction of vector map was made with the Summergrid ver4.0 digitizer of Summergraph and with the Geobase GDK function of Girlim System for smoothly map control.

At cadastral map management system, very important fact is data construction. Data construction of vector method is more expense than raster method but it has advantage of data reusing and accuracy. The Table-3 and Table-4 show necessary work contents for map construction.

Table-3. Necessary work contents for map construction of raster method

Computerization range		Land use plan paper issue affair
Construction data contents	Map data	Cadastral map, City plan map
	Input method	Scanning
	Map data amount	About 70000 field, 470 paper (1/500 40 paper)
Use equipment	Hardware	● Map input.output equipment(PC, Scanner) ● PC-LAN
	Software	● Oneself development S/W (Main control, Edit control, Scan control)
Etc		● As data construct, the staff edit and input in case of cadastral disagreement ● As scan input data(raster data), it is lower the use at other affair

Table-4. Necessary work contents for map construction of vector method

Computerization range		Land use plan paper issue affair
Construction data contents	Map data	Cadastral map, City plan map
	Input method	Vector
	Map data amount	About 40000 field, 1400 paper (1/500 1170 paper)
Use equipment	Hardware	● Map input.output equipment(PC, plotter, digitizer) ● PC-LAN
	Software	● oneself development S/W and business GIS TOOL, Digitize program(GEOBase, Autocad)
Etc		● In case of cadastral disagreement is input that way ● As vector data, it is high the use at other affair

3. Apply to Cadastral Map Management System
  3.1 construction of Cadastral Map Management System
In our laboratory, we developed a vector cadastral map management system which applied model area to

Pusan Haeundae office.

Cadastral map computerization system had been using with raster data at the office which developed cadastral map control system, so we could possible compare vector data method with raster data method. We spent to about 1 year for development of this system. Table-5 shows total construction progress for development of this program.

Table-5. Construction progress of program   (day)

Order	Process	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320
1	Analysis of affair and design for program	■	■	■	■												
2	Develop to input program and test					■	■	■	■								
3	Develop to output program and test									■	■	■	■				
4	complement the defect and the last test													■	■	■	■

In our laboratory, we developed a vector cadastral map management system which is divided at 4 level. First, we analyzed affairs and planed a frame of program. Second, we made out input program. Third, we made out output program. We checked imperfections. Table-6 shows a detail plan for a cadastral map management program.

Table-6. Detail plan for computerization construction of land use plan confirmation

Order	Process	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	360
1	Merge and Edit work of cadastral map	■	■	■	■													
2	Input and edit of city plan line					■	■	■	■									
3	Index work									■	■	■	■					
4	Data is applied to the program													■	■	■		
5	Educate to user																■	■

This program is base on digital map of vector data. And this program is 2-dimension GIS program which connect and control with attribute data.

3.2 Application of Cadastral Map Management System

The cadastral map is included in special map. It is just referred to the public, and isn't opened to the

public. Therefore, nobody can access it without a password except the person who is in charge for issuing cadastral map in the office operating cadastral computerization. Figure-3 shows a main screen of cadastral map management program.
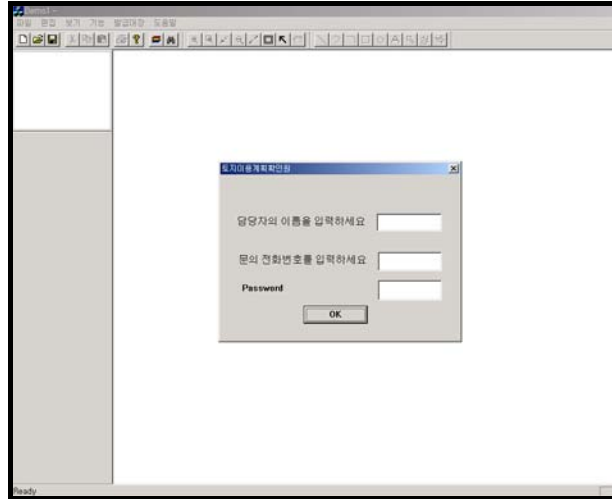

Figure-3. A main screen of cadastral map management program

Implementation of a vector cadastral map management system is as follows.

First, you have to put a name of a person in charge, phone number of inquiry, and a password after executing a program. There is a main screen. A vector digital cadastral map is converted into Geo file which is a drawing file in the Geobase. Selecting Geo file, you can open digital cadastral map. You can issue cadastral map and land utilization confirmation document using the number of land. Figure-4 shows a dialog box of searching the number of land.
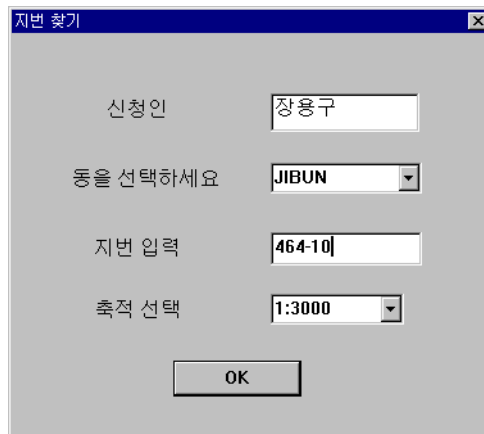

Figure-4. Dialog box for input the number of land

After input the number of land and execution, it is choose the scale then selected map is displayed on screen. Figure-5 shows to screen after input the number of land and choose the scale.

Figure-5. Screen after input the number of land and choose the scale.

Figure-6 shows print preview function of cadastral map management system. It shows print form on screen before the print.
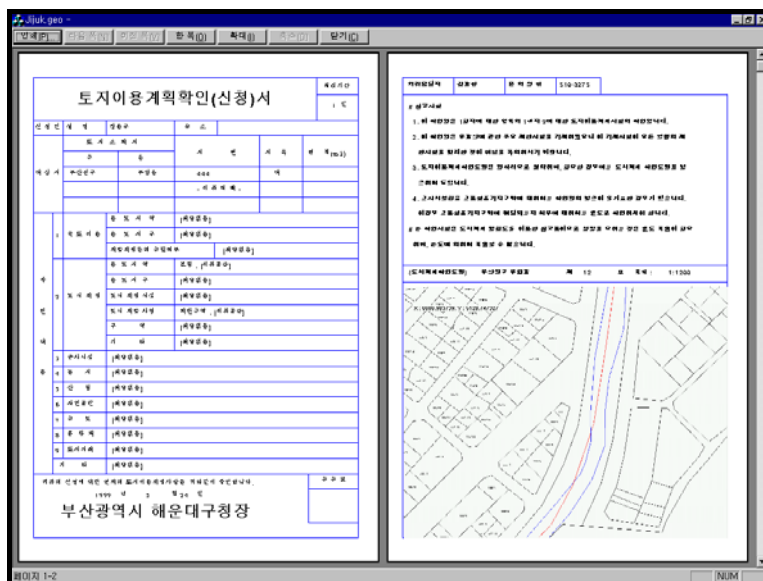

Figure-6. print form on screen before the print

4. Comparison Consideration

Now, the most offices have to many problems about cadastral map acquirement and relation matters because of handwork. Addition, In the most computerization ward office, cadastral map management has been problem because digital of cadastral map is controlled with raster method. We knew to a few problems thought-out this study. First, acquirement time spent about 30 minutes at ward office due to handwork so quick map acquirement was difficult. Second, changed city plan line or cadastral map acquirement of cadastral surveying contents is executed handwork so consistent affair is difficult. Third,

at the most ward office is control on the cadastral map with raster data so we can quick acquire and an efficient map manage, but it is difficult to input of accurate edit contents and reuse with cadastral map.

5. Conclusion

  This study was operated for cadastral map acquirement and efficient manage of related matters. After this study, we got conclusion as follows.

  First, in case of use this cadastral map management system for the acquirement of cadastral map, the acquirement time was reduced less than 5 minutes. Therefore, we expect to solution for waiting and double traffic of civilian.

  Second, in case of use this program, that will be solved pay for damage and disbelief for administrative because it is not occurred to a mistake from handwork. So, it can more raised to administration public trust.

  Third, in our laboratory, we developed a vector cadastral map management system which is manage to cadastral map of vector method, so it can accurately input to edited contents on map from city plan line or cadastral surveying, it can operated perfect matching between different scale map.

And, because the cadastral map of used vector method can continuous applied in future, all cadastral map management have to controlled with vector method in order to efficient manage to the cadastral map.

Reference Document

1. Jung Dong Hun, "Extending and reduction correction about cadastral map using boundary line", Masters Thesis, 1999

2. Ryu Hye Jong, "Auto topography object recognition and modeling for cadastral map application", Masters Thesis, 1995

3. Kim Jae Il, "plan and realization of topography object auto extract system for cadastral map", Masters Thesis, 1996

4. Ji Jong Daek , "Study of digital information of cadastral map", Masters Thesis, 1998

5. Kim Sang Su, "Cadastral system and computerization at foreign country", 1994, pp.46-50

6. Park Sun Gyun, Choi Yong Gyu, Kang Tea Suk, "Cadastral Introduction", Hyungseul publishing, 1994, pp.363-383

7. Pusan City, "Meeting paper about land utilization confirmation document computerization", 1997

8. Haeundae ward office, Report about land utilization confirmation document computerization acquirement, 1998

9. Uh Bok Mo, Fundamental theory of surveying(II), Parkyungsa, 1995, pp.66-99

10. Kang Tea Suk, Cadastral surveying, Hyungseul publishing, 1996, pp.57-92

11. Park Uhn Yong, Practical surveying, Hyungseul publishing, 1998, pp.515-566

12. Barry F. Kavanagh and S.J. Glenn Bird, SURVEYING(Principles and Applications) Fifth Edition, 2000, pp.546-590