REMOTE SENSING AND GIS INTEGRATION FOR HOUSE MANAGEMENT

Mu-Lin WU, Yu-Ming WANG, Deng-Ching WONG, Fu-Shen CHIOU

Department of Information Management
87-1 Nansh Li, Madou, Tainan 721, Taiwan
E-mail: mulinwu@yahoo.com.tw

ABSTRACT ... House management is very important in water resource protection in order to provide sustainable drinking water for about four millions population in northern Taiwan. House management can be a simple job that can be done without any ingredient of remote sensing or geographic information systems. Remote sensing and GIS integration for house management can provide more efficient management prescription when land use enforcement, soil and water conservation, sewage management, garbage collection, and reforestation have to be managed simultaneously. The objective of this paper was to integrate remote sensing and GIS to manage houses in a water resource protection district. More than four thousand houses have been surveyed and created as a house data base. Site map of every single house and very detail information consisting of address, ownership, date of creation, building materials, acreages floor by floor, parcel information, and types of house condition. Some houses have their photos in different directions. One house has its own card consists these information and these attributes were created into a house data base. Site maps of all houses were created with the same coordinates system as parcel maps, topographic maps, sewage maps, and city planning maps. Visual Basic.NET, Visual C#.NET have been implemented to develop computer programs for house information inquiry and maps overlay among house maps and other GIS map layers. Remote sensing techniques have been implemented to generate the background information of a single house in the past 15 years. Digital orthophoto maps at a scale of 1:5000 overlay with house site maps are very useful in determination of a house was there or not for a given year. Satellite images if their resolutions good enough are also very useful in this type of daily government operations. The developed house management systems can work with commercial GIS software such as ArcView and ArcPad. Remote sensing provided image information of a single house whether it was there or not in a given year. GIS provided overlay and inquiry functions to automatically extract attributes of a given house by ownership, address, and so on when certain house management prescriptions have to be made by government agency. File format is the key component that makes remote sensing and GIS integration smoothly. The developed house management systems are user friendly and can be modified to meet needs encountered in a single task of a government technician.

KEY WORDS: GIS, Remote Sensing, House Management, Water Resource Protection

1. INTRODUCTION

1.1 House Management

House management is very important in water resource protection in order to provide sustainable drinking water for about four millions population in northern Taiwan. According to the law, every single house in Taipei Water District has to be monitored closely. Sewage and garbage has to be managed on a house by house basis. Every house is confined to construction law that modification has to be reviewed in advance. Construction of a new building or a house has to obtain official certificate issued by Taipei Water District. Otherwise, it is subject to a large amount of fine.

1.2 Remote Sensing and GIS Integration

House management can be a simple job that can be done without any ingredient of remote sensing or geographic information systems. Remote sensing and GIS integration for house management can provide more efficient management prescription when land use enforcement, soil and water conservation, sewage management, garbage collection, and reforestation have to be managed simultaneously.

1.3 Objective

The objective of this paper was to integrate remote sensing and GIS to manage houses in a water resource protection district.

2. DATABASE CREATION

Table 1 indicates that more than five thousand houses have been surveyed and created as a house data base. One house card has its site map and very detail information consisting of address, ownership, date of creation, building materials, acreages floor by floor, parcel information, and types of house condition(figure 1). Some houses have their photos in different directions. One house has its own card consists these information and these attributes were created into a house data base. Site maps of all houses were created with the same coordinates system as parcel maps, topographic maps, sewage maps, and city planning maps. Table 1 shows there are five townships at Taipei Water District.

Table 1. Number of house cards by township

Township	Number of House Cards
DoubleRiver	388
Newshop	2315
Pinlin	1312
Stone	401
Wulai	948
Total	5364

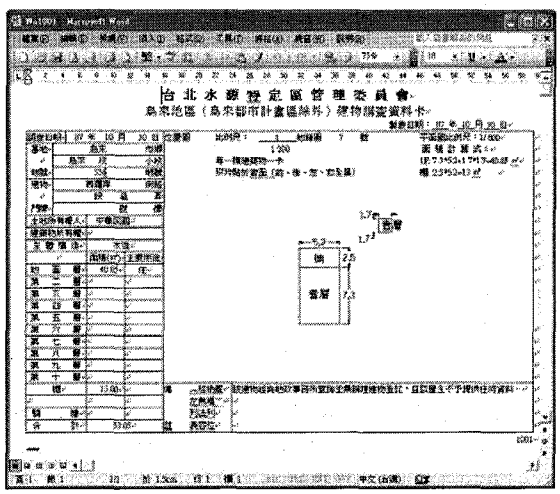

Figure 1. One house card for a given house.

3. DATABASE MANAGEMENT

Attributes in the house database can be manipulated by programs created by Visual Basic.NET and Visual C#.NET. House information by SQL commands can be performed in several ways such as by a single township. Figure 2 indicates that there are 1312 pieces of house records. That means there are 1312 records of house information at Pinlin township. Figure 3 shows that there are 948 pieces of house cards at Wulai township. Figures 2 and 3 are performed by a program written in Visual Basic.NET.

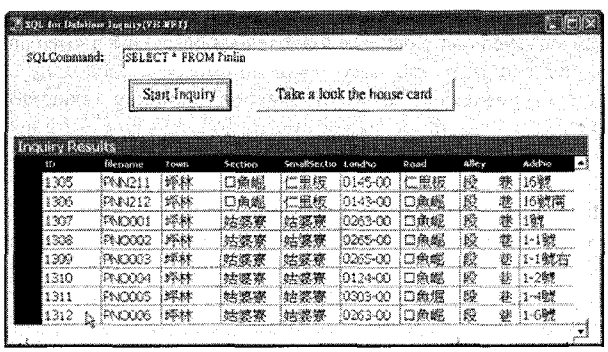

Figure 2. House inquiry by a SQL command (Pinlin).

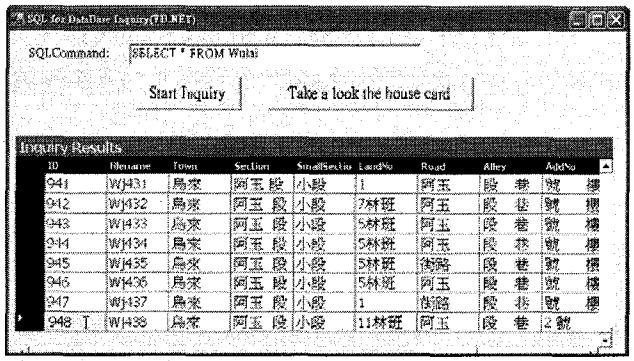

Figure 3. House inquiry by a SQL command (Wulai).

House information inquiry can be performed in many ways. Figure 4 indicates that house information can be extracted record by record. Figure 4 is performed by a program written in Visual C#.NET.

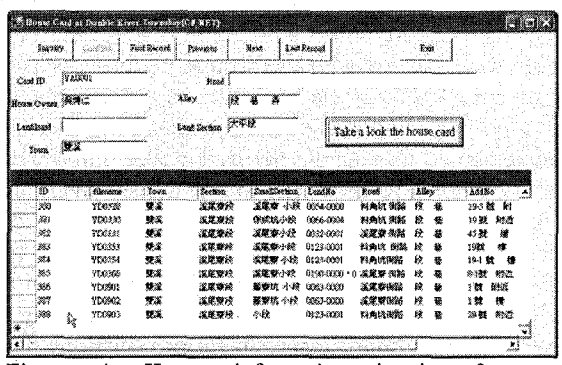

Figure 4. House information inquiry for a single township(Double River).

4. DIGITAL IMAGES MANIPULATIONS

All digital images such as satellite images, aerial photos, and orthophoto maps are subjected to preprocessing by image processing software. File format conversion and file header manipulations were done by free programs provided by ER Mapper (ER Mapper, 2006). ArcGIS and ArcPAD have been adopted plug-in programs provided by ER Mapper as well such that they can display images with ECW file format. Image enhancement was done by several digital image processing software.

5. REMOTE SENSING AND GIS INTEGRATION

Remote sensing and GIS integration for house management is not so complicate when ArcGIS or ArcPAD was utilized. Figure 5 indicates house site maps overlay with sewer system maps at one of the two watersheds in Taipei Water District. Figure 6 is an enlargement of figure 5. It shows very detail information for a single house and its associate sewer facilities. Figure 7 adds one SPOT image as a background information. One SPOT image can be replaced with other digital images such as digital orthophoto maps, Formsa II satellite images.

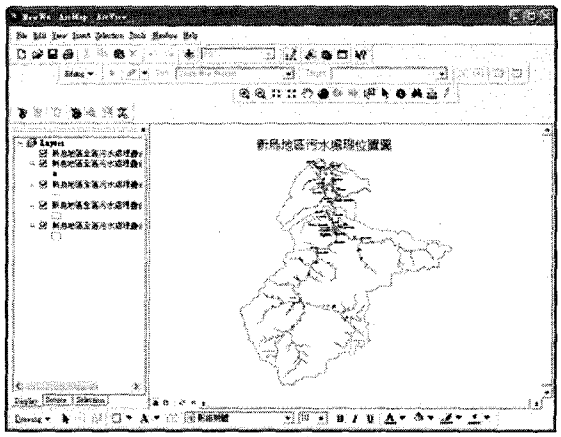

Figure 5. House site maps overlay with sewer system maps.

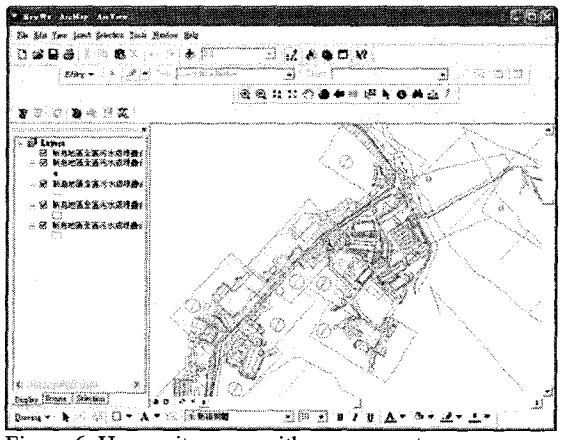

Figure 6. House site maps with sewage system.

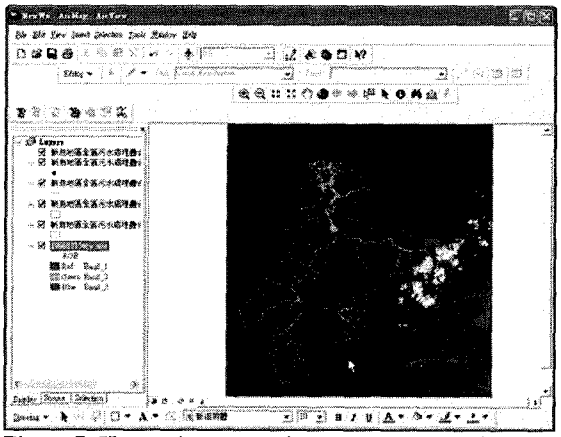

Figure 7. House site map and sewage system with SPOT image on the background.

Cadastral information is very important in water resource protection. Figure 8 shown all parcel maps for a given township, say, Stone township. Detail parcel information inquiry can be performed by mouse clicking which shown in Figure 9.

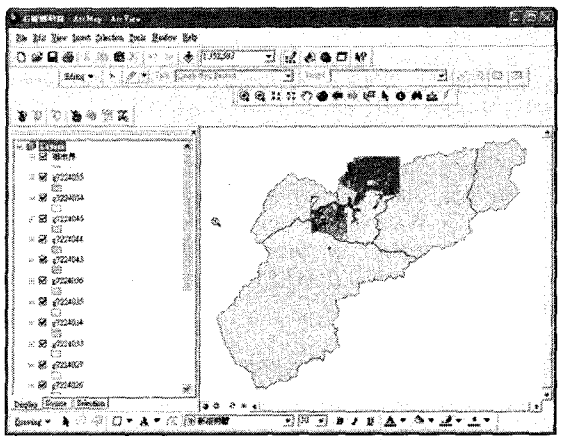

Figure 8. Parcel map for a given township(Stone).

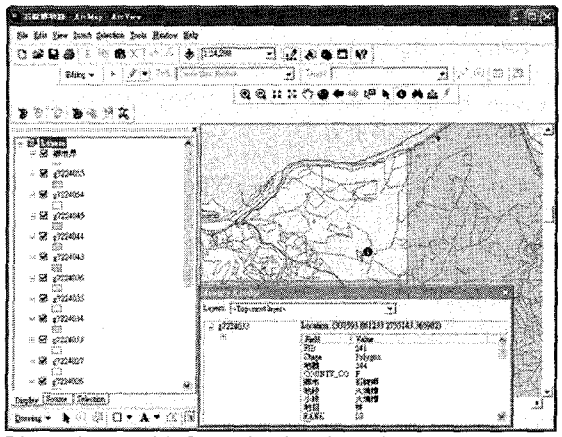

Figure 9. Parcel information inquiry using ArcGIS.

6. DISCUSSION

This paper implemented Visual Basic.NET and Visual C#.NET to develop programs for database manipulations. Database management functions can be performed by inquiry, to update the existing house database, and to retrieve a given piece of house card. Although it is a little bit of difficult for a GIS technician to write Visual Basic.NET and Visual C#.NET programs. But once if one can get in the right track on how to generate programs for database manipulations, one's capability in GIS and remote sensing should increase significantly. In the mean time, one should show more power in software manipulations such as ArcGIS, ArcPAD, and so on.

7. CONCLUSION

The developed house management systems can work with commercial GIS software such as ArcView and ArcPad. Remote sensing provided image information of a single house whether it was there or not in a given year. GIS provided overlay and inquiry functions to automatically extract attributes of a given house by ownership, address, and so on when certain house management prescriptions have to be made by government agency. File format is the key component that makes remote sensing and GIS integration as smooth as one can expect. The developed house management systems are user friendly and can be modified to meet needs encountered in a single task of a government technician.

7.1 References

Chang, Kang-tsung. 2002. *Introduction to Geographic Information Systems*. McGraw Hill. 348 pages.

Chang,Yan-Guang, Shang-Yao Tai, Der-Ren Song, Shiow-Feng Liu, Mu-Lin Wu, 2001, House Management for Land Use Enforcement at a Watershed Using a Self-Developed Web-Based GIS, *Proceedings of International Geoscience and Remote Sensing Symposium (IGARSS 2001)*, Sydney, Australia, 9-13 July 2001, 3 pages.

Chen, H. A. 2003. *VB.NET Programming (Chinese edition)*. Flag Publishing, Inc. pp. 14-1 to 14-44.

ER Mapper, Inc. 2006. http://www.ermapper.com/downloads/

Lung, K. C., K. S. Hong, Y. C. Chen. 2002. *C# Programming. (Chinese edition)* Flag Publishing, Inc. pp. 17-1 to 17-50.

Siler, B. and J. Spotts. 1998. *Special Edition Using Visual Basic 6*. Que Inc. pp. 490-497.

Wu, Mu-Lin, Yu-Ming Wang, Chien-Yih Fang , Ya-Yuien Huang. 2006. An Image Information System for Management of Watersheds in Remote Sensing Education. *Proceedings of 2006 IEEE International Geoscience and Remote Sensing Symposium and 27th Canadian Symposium on Remote Sensing (IGARSS 2006)*, July 31 to August 4, 2006, Denver, CO, U. S. A., 4 pages.