

# **Applications on Slope Land Management through GIS Technology**

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## **ABSTRACT**

Land resources in Taiwan are limited, and two thirds of the territory is the mountainous and hilly areas that can't be highly developed. Due to the population explosion, industrialization and urbanization in recent years, people gather in urban areas and the land prices as well as house prices keep going up. The slope land predominate three fourths of Taiwan Island becomes the target of urban sprawling. The limited land resources are getting less, worse, and beyond its tolerance under the circumstances of over-development. It is nonrenewable resource, which is hard to recover after destruction. Improper development causes damages to natural environment easily because of the complicated and special natural environment. Damages caused by natural disasters such as 921 earthquake and Toraji typhoon in recent years can approve the counterattacks of mother nature. Otherwise, insufficient human resource and heavy workload in supervising slope land developing behaviors lead to occurrence of frequently illegal development that is a threat to conservation and homeland security. Hence, RS, GPS, and GIS technologies are integrated and used to assist the monitorship on slope land development and to hold back the illegal behaviors.

**KEY WORDS:** Slope Land Management; Geographic Information System

## 1. Introduction

In recent year, the economy and the population of Taiwan are growing rapidly. Because the exploitation of plain is tight, it becomes more important of economic development and people's life in mountainside. But Taiwan is a seismic belt of the Pacific Ocean, the orogeny is frequent and the slope land in Taiwan are high and precipitous, friable of the geological structure and rushing of rivers, with abundant rainfall the soil will flow away quickly. So the unsuitable developing of slope land will bring about the collapse and disaster of debris flow, it will be a danger of people's life and properties.

The safety of slope land is interrelated of people's life and ecological balance. The management of slope land is important. In addition to monitor the legal development, it is putting a stop to the illegal development of slope land and going back to original.

A frame of slope land supervising would prevent from illegal development and to punish someone who is illegal development. In order to get the whole information, slope land management has to set up various ways to inform against about illegal development.

## 2. Slope land management of the Soil and Water Conservation Bureau in Taiwan

The Soil and Water Conservation Bureau is an organization of government in Taiwan that devoted to management and investigations of slope land. There are eight sections in this organization, and the responsibility of the organization is in charge of planning, conservation of slope land, watershed protecting and monitoring and management of mudslide. Besides, there are six engineering institutes that assist in business about the Soil and Water Conservation Bureau. Duties of this organization are:

- a). Post-disaster land rehabilitation in regions affected by the chi-chi earthquake and reconstruction of farming communities.
- b). Mountain ecosystem conservation and disaster prevention, and overall planning and management of river confluence areas.
- c). Formulation of a slope land disaster prevention system, monitoring and prevention of landslide disasters, and implementation of contingency measures.
- d). Slope land management and investigations into illegal use of slope land.

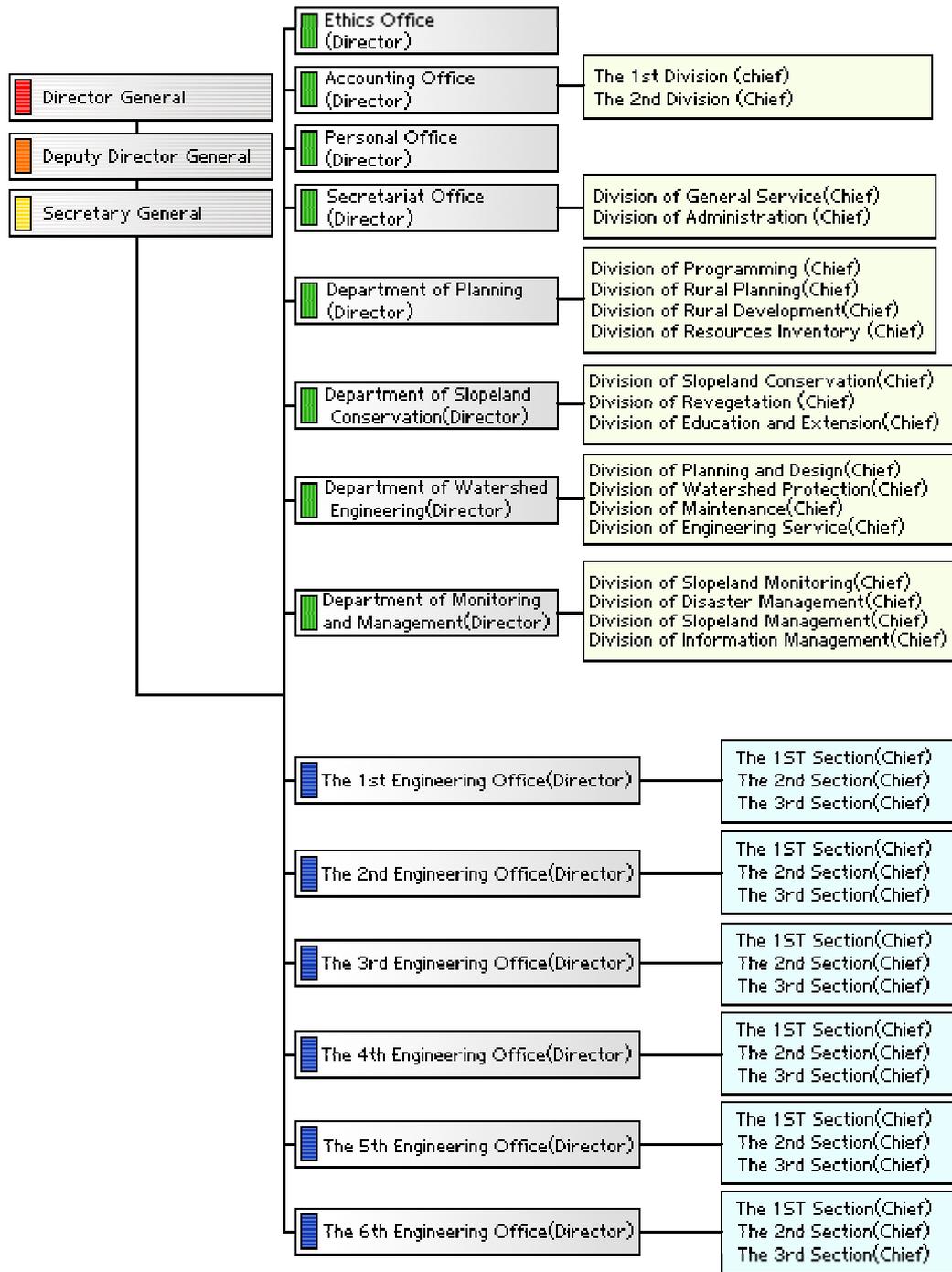


Figure1. The organization of Soil and Water Conservation Bureau

### 3.The Architecture of slope land management system

The Soil and Water Conservation Bureau developed a business-orientated and web-version application systems that help to data sharing and business promotion system named “Slope land Management System” . It divided into four subsystems, names of them are “Ratification and Supervision Management System”, “Slope land Inspection Management System”, “The Illegality Prosecution and Ban Management System”, and “Management System for Security Check of Conservation Facilities”. They help to manage, develop and transmit the real-time data, and grasp the cruxes immediately for reducing the damages by taking prevention solutions.



Figure2. Four subsystems of Slope Land Management System

The database of slope land management system attaches to ORACLE, and ESRI Arc SDE is the medium that exchanges data from application to spatial data. The architecture of the database is three-tiers. Users can't connect to data base server directly. If they want to get data from slope land management system database, they have to get them through Internet server. The purpose of this way is to insure the security of database. Besides, planning a complete of user's power is important, it will monitor the access of user's operating.

System users send their request from their own personal computer through Internet to the application server of slope land management system. The system will get user's request, connect to spatial database, get data that user's request then send data to the user through Internet and show the result to application. All of users' requests of system are controlled by users' power setting and that will improve the security of database.

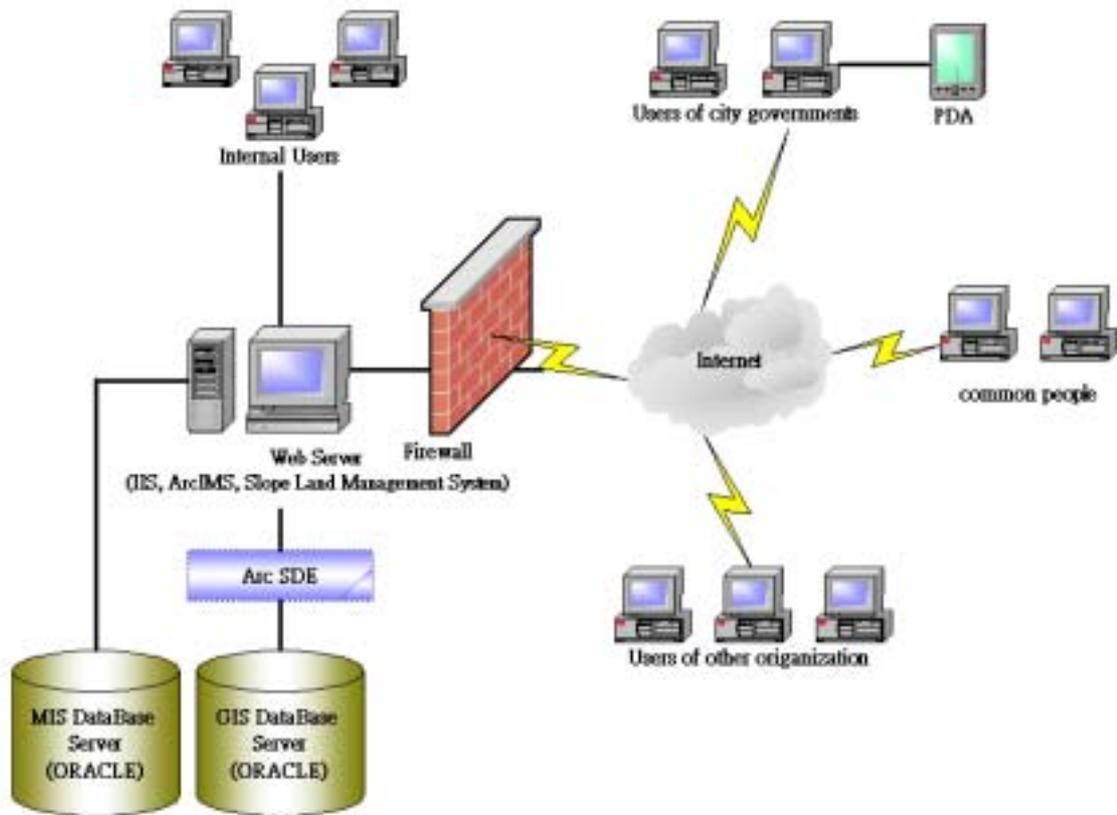


Figure3. System Environment of Slope Land Management

In order to provide a county government more efficient management of slope land, the Soil and Water Conservation Bureau built a procedure to manage slope land, each step is:

- (1) Setting the ways to inform against about illegal development in slope land management system.
- (2) To operate in coordination with SPOT satellite images, and to compare the different between the earlier images and the latest images.
- (3) In order to enhance the management of changed point areas inspection, the Soil and Water Conservation Bureau has to input data to the slope land database server,
- (4) Slope land management system would provide a speedy way to get information, and the system would guide the people to verify the scene.

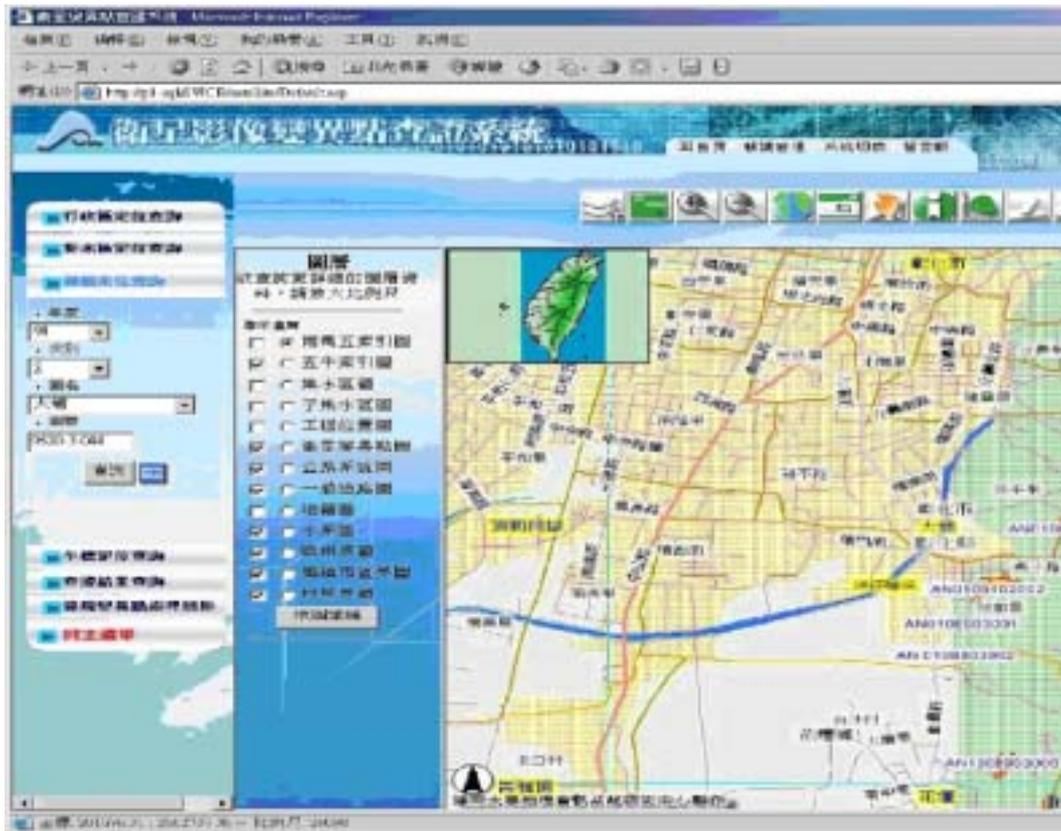


Figure4. Looking up the result of inspection by a district.

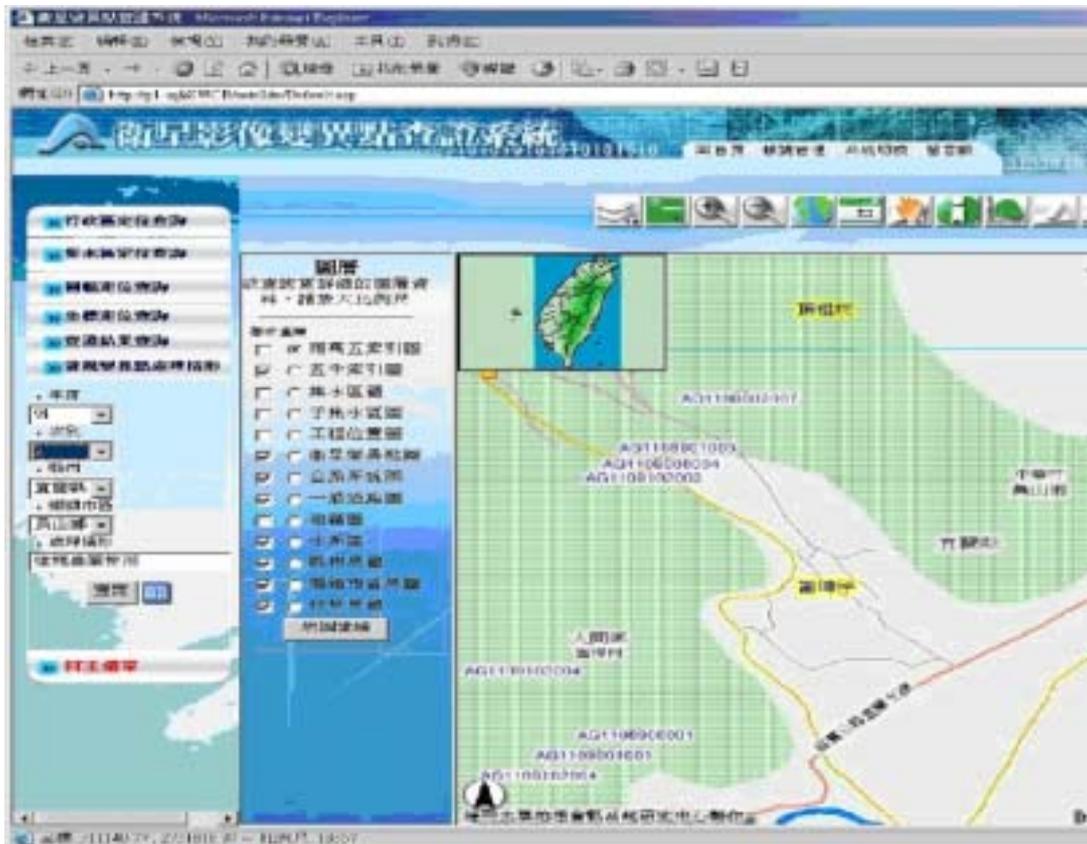


Figure5. Looking up the result of inspection by a changed point area



Figure6. Overlapping satellite images to the result of inspection.



Figure7. Overlapping aerial photographs to the result of inspection.

Users of city governments also download data that want to inspect to the PDA. They take the PDA to the scene and inspection and then keep track of the scene's state and result of inspection into the PDA. They also take some photograph from the scene. While all steps are completed, promoters have to upload data from PDA to slope land database through Internet that will get a great effect of managing and responding emergencies in time.

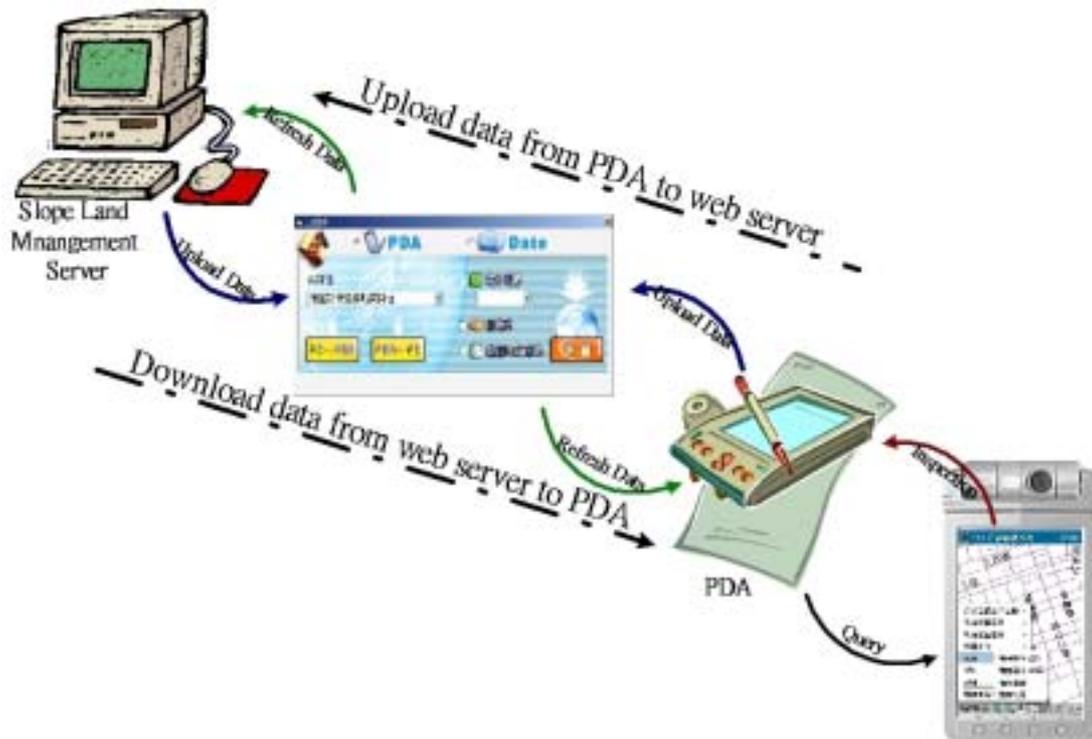


Figure8. The procedure of data transform between web Server and PDA

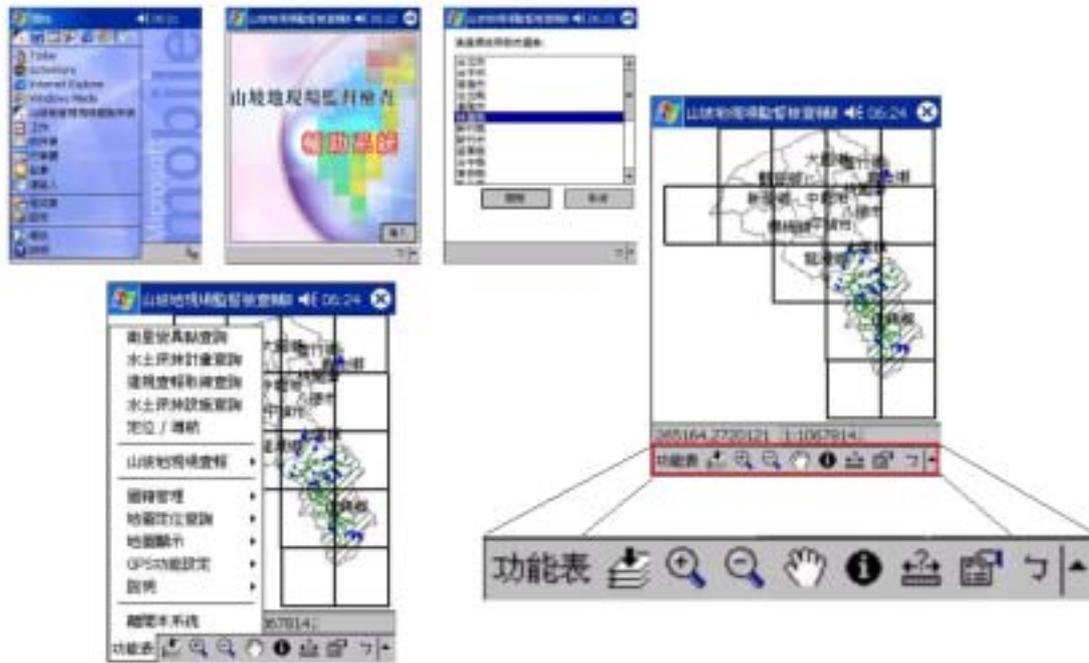


Figure9. Interfaces of slope land management system in PDA



Figure10. Application of slope land management system with PDA

#### 4. Conclusion

Web GIS for Slope Land Management System is planned and developed to provide an integrated and web operation system, meanwhile, database is built with normalized database structure and integrated spatial and attribute data.

The slope land predominates the territory in Taiwan, and the complicated slope land management business can't be coped with by the traditionally artificial methods. To maintain the whole environment resource. The Soil and Water Conservation Bureau uses GPS, GIS, RS and MIS technologies to assist the business on slope land monitoring and management in recent years. Those actions are expected to manage the slope land monitoring business effectively.