An application of Google Earth for Forest Inventory in Alishan area

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ABSTRACT: Forest inventory and analysis provides fundamental information for forest management and involves many labor works. Some large scale investigations need detail planning and tasks integration. Information sharing is on first priority of the project management. 3D-Web-based GIS is an efficient system allows users retrieve, store, update, processes, and display various kinds of geographical information, and provide users a platform to understand the work-plan and access recently results. Among these systems, Google Earth provides a simple and profuse interface, familiar with general user who needed no additional training to operate the system. This research shows a system using Google Earth to integrate information of forest inventory and analysis in Alishan area. Workflow includes data collection, system demand definition on general user and investigation staff, system architecture and database design. System is implemented by tools of ArcGIS Server 9.2 , ASP.NET 2.0, SketchUp 6 and Web Map Service(WMS) of ArcIMS. In order to increases mapping accuracy, aerial photo is draped on the Google Earth platform served as base-map. Integration of websites and Google Earth interface, the system allows project members sharing survey data and video, information inquiring, and make decision through a 3D visual environment.

1. INTRODUCTION

Telemetry image of a WAN Overview, forests provide the basic information management, forest camps Most of the staff have the use of remote sensing images flight training and experience, if convenient telemetric information supply channels for the business can provide quick reference. Forest Camp of the work, using the most direct route telemetry image is the work of forest resources survey operations, such as the previous (third) of forest resources survey, in the July 1989 start planning for preparation, March 1990 to team up and start formal training began in May,field investigations In September 6, 1993, the completion of all investigations. Survey data processing and geographic information system from the beginning of July 1989 planning, in July 1990 started procurement-related hardware and

software equipment, and personnel training, and survey data in conjunction Dundas and land-use map of the few recorded. In July 1992 until about information processing and analysis, in December 1995 still continue to address (the Forestry Bureau, 1995), that the follow-up national survey data processing and the complexity, the survey for the planning, design, investigation, the information on the whole, different from the forest officers Offices throughout the implementation, in order to help users understand the plan and inspect the contents findings, the network can use 3D geographic information systems, capture, storage, updating, processing and display of various types of geographic information platform. Currently the Forestry Bureau and the agricultural aircraft has been provided by the website for information on business or geographical themes as freedom Index, but less support resources to provide imaging and geographic information displayed on the integration of technical services (ITRI, 2006), this study to Google Earth virtual globe as a platform through written KML, with aircraft as Fig. Google Earth terrain. Alishan like to note, for example, front-end tools for Google Earth platform information service platform, and joined the Alishan area like photographs and film of the real situations URL, forest resources survey will be the geographical information in a new way and pipeline showed results for the forestry staff and telemetry of a fixed remote access to research results and technical support for the pipeline.

2. System Analysis and Choice

The system aims to satisfy users browse the sharing of information with the designated target, the man-machine interface platform for the design is very important in this section is that many 3D geographic information software, the final decision when using Google Earth platform and Microsoft Studio 2005 target for the system development platform of choice:

2.1. The Choice of Solutions to Define Conditions:

Development tools need to meet 'effectiveness' and a' comprehensive development speed options specific conditions include:
A. compatible with the Windows 2003 Server operating system
B. sufficient ability to handle computing operating systems and application programs
C. To facilitate the development environment

2.2. In Reviewing Solutions:

A. VRML + Microsoft Vistual Studio 2003
B. Virtual Explore + Microsoft Vistual Studio 2003

C. Google Earth + Microsoft Vistual Studio 2003
D. VRML + Microsoft Vistual Studio 2005
E. Virtual Explore + Microsoft Vistual Studio 2005
F. Google Earth + Microsoft Vistual Studio 2005

2.3. Selection Criteria:

A. Costs include: (a), the costs; (B), time cost; (C) human cost;
B. Products Expandability
C. Risk
D. Performance Technology
E. Operational interface
In various systems, the company developed software for Virtual Earth Google Earth, the satellite can photograph, aviation photography and GIS deployed in a three-dimensional model of the Earth. Use a complete Geographic Information System, which can store very large space information, a rapidly showing a relevant areas of electronic and Fig. And according to the need to provide space information, enables users to operate a computer screen, superimposed, reorganization or vacuum. As easy to operate and provide a wide range of information, Google Earth widespread public support, many users on a promotional advantage. Based on selection criteria, the final selection of the solution is Google Earth with Microsoft Studio 2005 target, the reasons for the selection:
A. Windows operating systems support of the good.
B. Adequate support all applications development.
C. Development of the ad hoc members have relevant experience.
D. Costs competitive.
E. Interface with operational compatibility.

3. System Implement

This study area on a flight telemetry application of advanced technology development program 'in the kind of Alishan area, is working on the use of materials and methods are as follows:
A. collect information on real situations, including Alishan photographs, films, reports and three forest resources survey reports.
B. Analysis of Google Earth and platform information from the main structure, KML grammatical structure, design the database structure and data flow Fig. .
C. Microsoft IIS 6.0 Web server, SQL Server as a database server, Flash, website HTML, and ASP.NET for the development of language.
D. Conversion the film format to FLASH format.

E. Coding with HTML to construct Alishan flash animation.
F. Fit web page template of forest remote sensing web site.(http://frs.org.tw)
G. Use SketchUp software to build Alishan 3D Building.
H. Coding with KML.
I. Test on Google Earth.

3.1 Alishan Web Page Implement

This study collected by the Alishan area and the kind of film materials through Microsoft Studio 2005 development tools and ASP.NET 2.0, using software for the real situations of the film Flash file format conversion, through writing HTML Object syntax built at the website, the final version of Visual Design quote forest telemetry website (http://frs.org.tw) version of the same type, through the compiler build on its Web site. The establishment of the website URL link through KML grammar, they can click on the Google Earth to links this page. Alishan area web page is shown as Fig. 1.

Fig. 1. Alishan Area Web Page

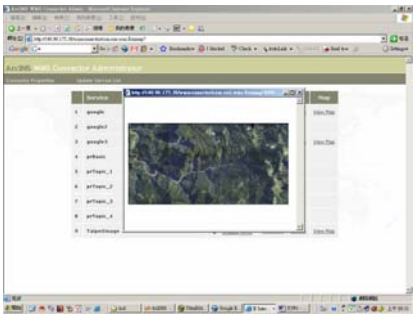

Fig. 2. WMS Connector Administrator Alishan Spot Photo Preview

3.2 Alishan Spot Photo through ArcIMS Web Map Service affixed to the Google Earth terrain, building steps:

A. Enable Alishan Spot Photo Service in WMS Connector Administrator (Fig.2).
B. Add Image Overlap in Google Earth, the URL is:
http://140.96.175.38/wmsconnector/com.esri.wms.Esrimap/google3?request=getcapabilities&service=WMS&version=1.1.1
C. The Steps of adding image overlaps on Google Earth as shown on Fig.3~Fig.8.

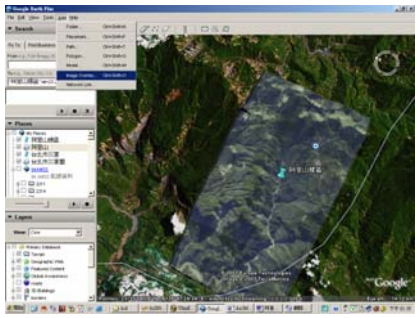	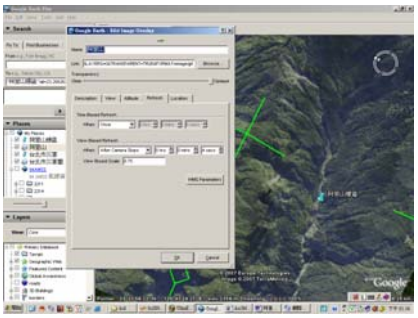	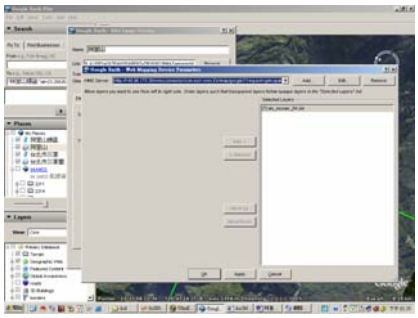
Fig. 3. Add →Image overlay	**Fig. 4.** Refresh Tab → WMS Parameters	**Fig. 5.** Click Add Button
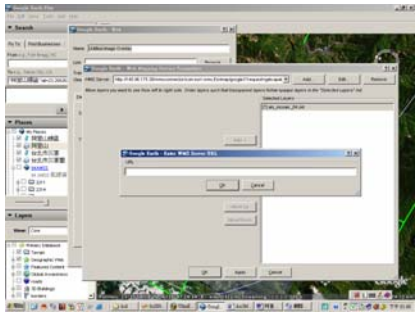	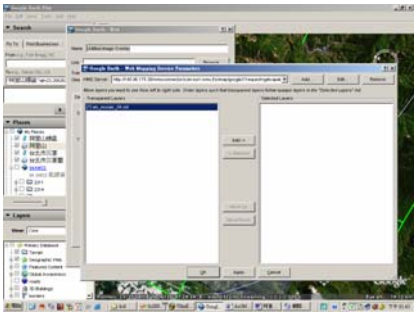	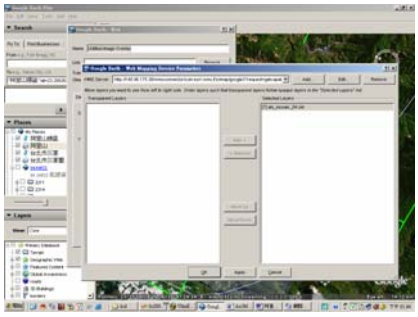
Fig. 6. Paste The WMS Service URL of Alishan Spot Photo	**Fig. 7.** Click Layer[1]	**Fig. 8.** Click [OK] Button to Finish Setup

D. Alishan Area Spot Photo Preview on Google Earth

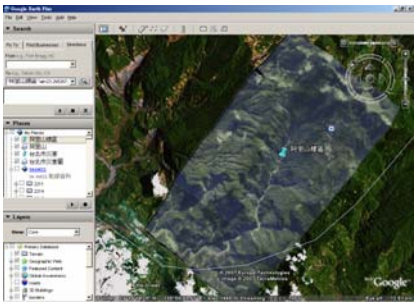	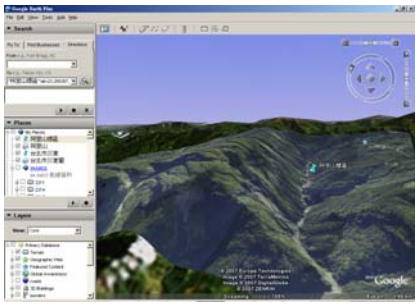
Fig. 9. Alishan Spot Photo Preview 1	**Fig. 10.** Alishan Spot Photo Preview 2

3.3 Building 3D Model with SketchUp

A. Click “Get Current View” Function To Import Photo From Google Earth
B. Click “Rectangle” Function to draw a rectangle
C. Click “Push / Pull” Function to build Z axis of the rectangle
D. Click “Line” Function to build the roof
E. Click “Move / Copy” Function to build Z axis of the roof
F. Click “Rectangle” Function to build the door and windows
G. Click “Paint Bucket” to color the building
H. Click “Toggle Terrain” Function to adjust the terrain
I. Click “Move / Copy” Function to adjust the building position

J. Finally Click “Place Model” to Export to Google Earth and save file
K. If find a ready-made model from the 3D Warehouse of Google Earth, or use the “Get Models” to search for the model you want.
L. They can be built to upload 3D objects in the 3D Warehouse share to others.

3.4 Written KML

A. In <Placemark> under <name> labeling items imported Chinese, in Google Earth can show Chinese labels.
B. Under the <Placemark> <description> input link has been built within the Alishan graphic films and website URL, Google Earth in the PopUp windows display the relevant links.
C. In the course of writing KML, Notepad to edit completed, the stored files, in order to show the Chinese Google Earth without a gibberish phenomenon, in the file storage, will be set UTF-8 encoding (Fig.10).
D. Placemark can modify icons for their favorite design, a camera icon of this study, drawing for icon46.png connecting at http://maps.google.com/mapfiles/kml/pal4/icon46.png. KML source code See the appendix hereto.

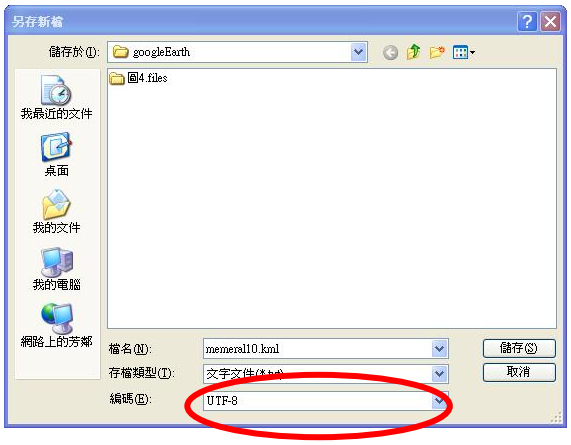

Fig. 11. KML Save File With UTF-8 Coding

4. CONCLUDING REMARKS

The use of Google Earth KML grammar written in Alishan like pictures and text descriptions and links to web sites can link to the website has been built, through the display of real situations and other details of the film; Spot Photo overlaying through ArcIMS Web Map Service, will be funded through the services of the establishment , and open links with Google Earth fooled maps, 3D Building Model through SketchUp build, and export to the Google Earth,pictures shown as Fig.11~Fig.19.
The use of the new application platform to forestry management staff through Google Earth to display and share information through a link KML pipeline through WMS can be affixed

with high-resolution images of flights through SketchUp software built a 3D, this study provides a model approach to 3D visualization A new analysis of the way.

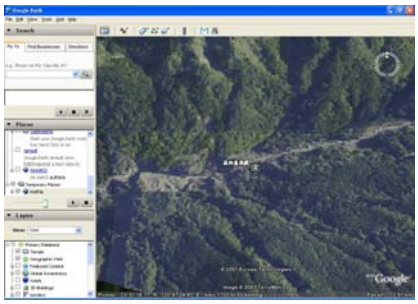

Fig. 12. Coding with KML PlaceMark Alishan Area

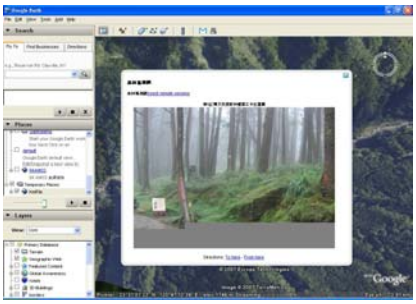

Fig. 13. Click URL To Show Pop Up Window

Fig. 14. Link To Forest Remote Sensing Website

Fig. 15. Alishan Area Introduction

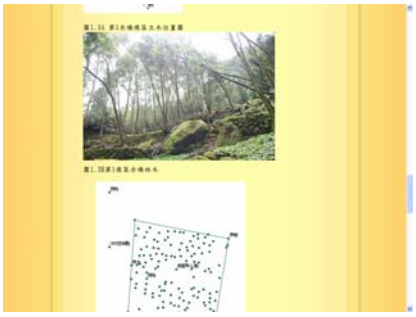

Fig. 16. Alishan Area Picture and Point

Fig. 17. Alishan Area Reality Movie

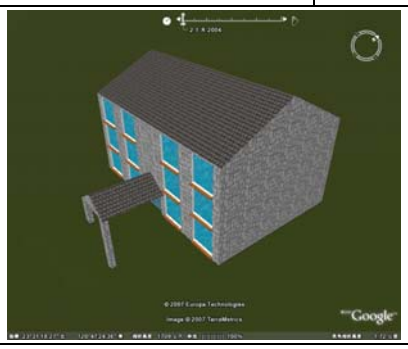

Fig. 18. Alishan Area 3D Building Front Side

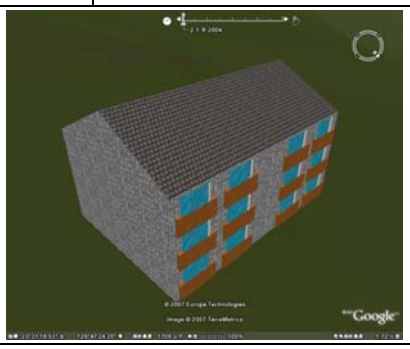

Fig. 19. Alishan Area 3D Building Back Side

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Forestry Bureau, 1995, Third Taiwan forest resources and land use survey (in Chinese)

Google Earth website ： http://earth.google.com

Martin C. Brown, 2006, Hacking Google Maps and Google Earth

David A. Crowder, 2007, Google Earth For Dummies

Google Earth 3D Warehouse website: http://sketchup.google.com/3dwarehouse

APPENDIX

A.1 Pop-Up Window KML Source Code

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://earth.google.com/kml/2.1">
<Document>
	<name>KmlFile</name>
	<Style id="sh_icon38_copy1">
		<IconStyle>
			<scale>1.1</scale>
			<Icon>

	<href>http://maps.google.com/mapfiles/kml/pal4/icon38.png</href>
			</Icon>
		</IconStyle>
		<ListStyle>
		</ListStyle>
	</Style>
	<StyleMap id="msn_icon46_copy1">
		<Pair>
			<key>normal</key>

	<styleUrl>#sn_icon46_copy1</styleUrl>
		</Pair>
		<Pair>
			<key>highlight</key>

	<styleUrl>#sh_icon38_copy1</styleUrl>
		</Pair>
	</StyleMap>
	<Style id="sn_icon46_copy1">
		<IconStyle>
			<Icon>
	<href>http://maps.google.com/mapfiles/kml/pal4/icon46.png</href>
			</Icon>
		</IconStyle>
		<ListStyle>
		</ListStyle>
	</Style>
	<Placemark>
		<name>森林遙測網</name>
		<description>
			森林遙測網
			<a href="http://140.96.175.65/frs/alishan.aspx">forest remote sensing</a><br/>
			<![CDATA[<div align='center'><font>第 4 紅檜天然更新林樣區立木位置 Fig.</font><br/><tr><td>
			<img src='http://140.96.175.65/frs/image/image019.jpg'></td></tr></div>]]>
			</description>
		<LookAt>
	<longitude>120.7899972</longitude>
			<latitude>23.52179167000002</latitude>
			<altitude>0</altitude>
			<range>1000.000300664792</range>
			<tilt>8.788224812122243e-028</tilt>

	<heading>3.915789268722692e-015</heading>
		</LookAt>
	<styleUrl>#msn_icon46_copy1</styleUrl>
		<Point>
	<coordinates>120.7899972,23.52179167000002,0</coordinates>
		</Point>
	</Placemark>
</Document>
</kml>
```

A.2 3D House KML Source Code

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<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://earth.google.com/kml/2.1">
<Folder>
	<name>SUPreview2</name>
	<open>1</open>
	<description><![CDATA[Created with <a
href="http://sketchup.google.com/">Google SketchUp
6.0.515</a>]]></description>
	<LookAt>
		<longitude>120.7901445970354</longitude>
		<latitude>23.52148118357392</latitude>
		<altitude>26.05123860118659</altitude>
		<range>36.88317681628242</range>
		<tilt>52.8129</tilt>
		<heading>331.774</heading>
	</LookAt>
	<Folder>
		<name>Tour</name>
		<Placemark>
			<name>Camera</name>
			<LookAt>

	<longitude>120.7901445970354</longitude>

	<latitude>23.52148118357392</latitude>

	<altitude>26.05123860118659</altitude>

	<range>36.88317681628242</range>
				<tilt>52.8129</tilt>
				<heading>331.774</heading>
			</LookAt>
		</Placemark>
	</Folder>
	<Placemark>
		<name>Model</name>
		<Style id="default">
	</Style>
		<Model id="model_1">
	<altitudeMode>relativeToGround</altitudeMode>
			<Location>

	<longitude>120.790005144822</longitude>

	<latitude>23.521787276461</latitude>
				<altitude>0</altitude>
			</Location>
			<Orientation>
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				<tilt>0</tilt>
				<roll>0</roll>
			</Orientation>
			<Scale>
				<x>1</x>
				<y>1</y>
				<z>1</z>
			</Scale>
			<Link>

	<href>SUPreview2.kmz/files/SUPreview2.dae</href>
			</Link>
		</Model>
	</Placemark>
	<DocumentSource>SketchUp</DocumentSource>
</Folder>
</kml>
```