

APPLICATION OF PUBLIC PARTICIPATION GEOGRAPHIC INFORMATION SYSTEM IN ECOTOURISM DEVELOPMENT FOR LOCAL COMMUNITY

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ABSTRACT: The purpose of ecotourism is to protect the cultural and natural resources, and to benefit the economic development and political empowerment of a local community. This study mainly focuses on establishing a Public Participation Geographic Information System (PPGIS) for use by the local community in ecotourism development planning. Specific objectives of this research include: (1) integrating mobile device with GPS for collecting spatial data about resources, which are then incorporated into a GIS geospatial database; (2) using Google Maps/Google Earth API and JavaScript to design dynamic web pages to facilitate information dissemination; (3) providing dynamic maps, relevant information, and analytical tools to promote public participation in the discussion and planning process for ecotourism development.

1. Introduction

Although Taiwan has only 3.6 million square kilometers of area, it still owns variety of living things and creatures. The ecotourism could let people learn different environment through understanding the cultures and naturals. Currently a lot of rural communities are devoted to developing ecotourism, and promoting community cultures and natural resource. The purpose of ecotourism is not only to achieve the conservation, but also benefit the economic and increase the local resident's income for community development.

In order to attract more tourists, the ecotourism usually demand good allocation for attractions as well as biological resources, and appropriate tourist routes plan. With the aid of spatial information technology, geospatial data can be collected and used for various processing, application or analysis, and data could be displayed on the computer interface. GPS tracking device can record three-dimensional coordinates and time information, and it's cheap and easy to carry. For scenic spots or spatial location of biological resources, one can effectively use GPS tracking device to collect their coordinates and make them displayed on the digital maps. Moreover, GIS provides interfaces for showing of geospatial data and digital maps, and allows users to build or manage a database by graphical user interface. Despite some GIS is expensive, nowadays there is much GIS software such as Quantum GIS (QGIS) or Google Earth which could be downloaded free via the Internet. GIS has been widely used in much domain. For example, web based GIS provide ideal platforms for the convergence of tourist information and their analysis in relation to surrounding social conditions, spatial characteristics, location and the natural environment. For Government or community organizations, GIS can be an auxiliary tool in developing ecotourism. In addition to promote the conservation and economic, the other important object of this research is to encourage greater public participation in community development. For this reason, by establishing Public Participation Geographic Information Systems (PPGIS) platform, participators will be able to communicate with each other on the platform.

Research and development of PPGIS has been a branch of GIS study for more than a decade. It demands open access to information, and may well provide a basis by which information managers can approach data access issues (Carver, 2003). About communities, PPGIS regards GIS as a communication platform for each type of issue, and allow the information such as location, resources, and transportation to be displayed on the digital platform. In addition, with developing a website management system with high efficiency, it can present a variety of spatial information in more ways. Django is an open source Python Web framework that encourages rapid development and pragmatic design in web applications. One can develop dynamic web pages integrated with spatial information and manage websites through Django, Google Maps/Google Earth API or JavaScript, which let people of the community understand the status of various resources, and can be used as a tool for assisting the community in developing ecotourism. At present, Danei community, located in Tainan, belongs to a rural community with high potential of development. It owns many agricultural products, a diversity of biological resources, and spectacular

views of the landscape. Therefore, this study mainly focuses on establishing a PPGIS for use by the local community in ecotourism planning, and making more residents to participate in the discussion.

2. Method

2.1 Investigating and Collecting Data

The collection of geospatial data mainly includes Danci topographic maps, satellite images, the locations of public facilities, rivers or lakes, roads, biological or landscape resources, and routes of protected forests. First, the mainly method in this research is using GPS tracking device to collect in situ data. The area of study site is not so wide that it's possible to pass through each location by walking or biking and let the device immediately position with collecting three-dimensional coordinates. The appearance of GPS tracking device is shown in Figure 1, and the volume is small as well as easy to carry. Collected data can be loaded in the computer through @trip PC software. Moreover, with digital cameras, one can obtain digital photos of ecological resources such as insects (Figure 2) or plants and landscape. Finally, confirming the actual photographic location by matching recorded time in the device and cameras.



Figure 1 GPS tracking device

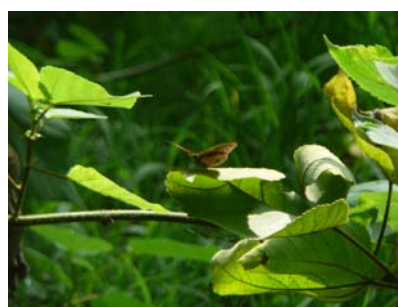


Figure 2 Photos of ecological resources

2.2 Establishing the Database with Google Earth

Google Earth provides marking and editing points, line, or polygons on the maps. It can apply in display of resources, routes, even or satellite images. In addition, all data can be saved as KML or KMZ files in Google Earth.

This study aims to establish database for biological resources, landscape, and artificial scenery in Google Earth. For example, in Figure 3, it depicts investigation of biological resources from May to October. Generally the investigated items involve insects, amphibians, reptiles, birds and other invertebrates. As GPS tracking device can only records the coordinates and time, merely the simply data points will be imported in Google Earth by some auxiliary software. Users still need to edit more contents and attributes and make the data linked to related photos taken by digital camera according to each species. And according to different data collected in each month, it would

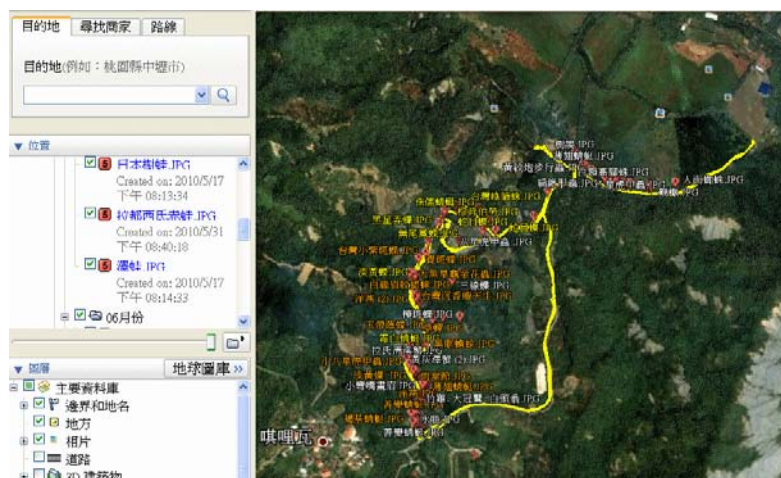


Figure 3 Database in Google Earth

be saved in different layers. Moreover, in Figure 3, it also shows the routes of protected forests recorded by GPS tracking device, and the yellow lines represent the routes.

2.3 Establishing the GIS Database

At present, the Danei geographic database is build manly in ArcGIS 9.3. The contents of all layers generally contains routes, rivers, public facilities like schools, parks or temples, location of biological resources, protected forest areas, satellite images, Danei digital maps and contours. All data used TWD97 coordinate system, and if there is some data originated from different coordinate systems, the georeferencing and transformation are necessarily process. Since Danei community belongs to a remote area, sometimes it's not easy to find out certain names of roads or scenic spots from the electronic or general maps. As shown in Figure 4, the locations of protected forests, roads, biological resources are marked on the GIS interface. The black lines represent the routes, the blue lines represent the rivers, the pink areas represent the protected forests, and the green points are the locations of biological resources. Furthermore, the orange areas indicate the DTM which produced from 30-meters contours, and the dark parts represent higher value of the elevation. In addition, satellite images can also overlap the other layers for displaying (Figure 5).

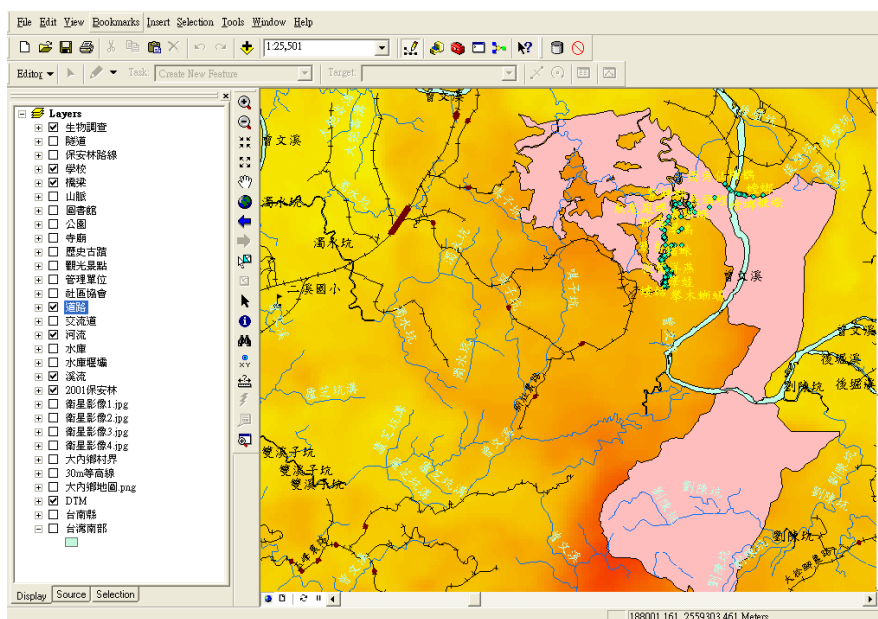


Figure 4 Database in ArcGIS 9.3

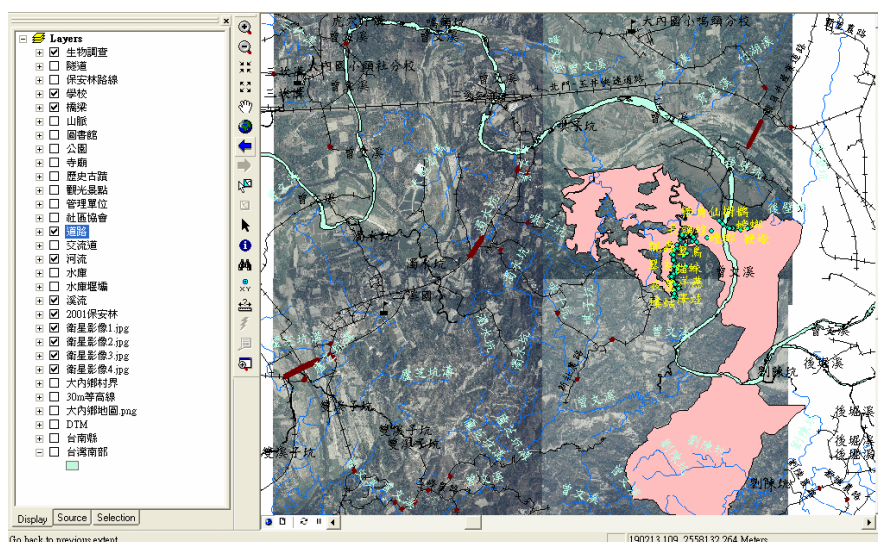


Figure 5 Satellite images are displayed in ArcGIS

2.4 Using QGIS to establish the database

Considering economic constraint of the rural community and high cost of ArcGIS, this study attempts to replace ArcGIS with QGIS software which can be obtained via the Internet and without payment. Therefore, it important to hold education and training for introduce this software to the local residents so that allow the users be able to simply manage the geographic data or analysis of operations in the QGIS. Besides providing the basic functions of

editing or drawing, QGIS also owns some additional functions such as georeferencing, buffering and overlapping. Figure 6 shows establishing multi-layers of roads, rivers, schools, mountains, and satellite images, etc. Each layer is presented with the appropriate symbols, lines, or color. For instance, the small and intensive red points present the location of biological resource. The black lines are routes. The shallow blue lines represent the rivers, and the orange parts are the protected forest.

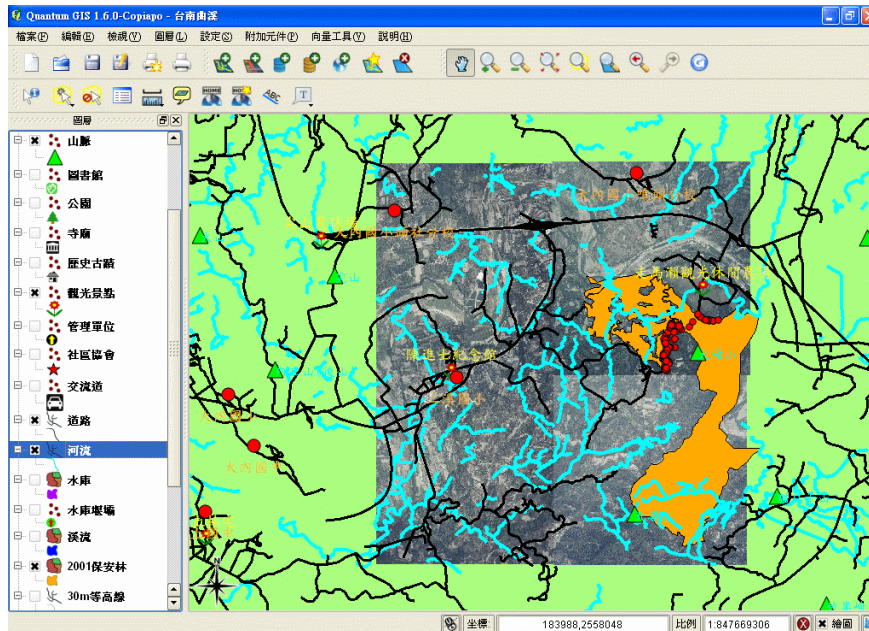


Figure 6 Database in QGIS

2.5 Designing and Managing Dynamic Web Pages

By building a web site, all local residents or other users can share information with each other via it. For designing dynamic web pages, users can try to embed Google Maps in ones' own web pages (Figure 7) by Google Maps API. The API also provides a number of utilities for manipulating maps or adding content to the map through a variety of services. Besides information exchange, users still need to share geospatial data, pictures or media by downloading or uploading from the web site. Therefore, it's possible to use web framework (Django) with Google Maps API to strengthen the database management, and query or analysis of functions. Through the Internet platform, users can understand the community's resources, and express opinions. Moreover, it may let more people are able to participate in the community development and assist in ecotourism planning.



Figure 7 Using Google Maps API in designing dynamic web pages

3. Result

3.1 Using Google Earth Data to Create the Animation

After adding geographic data in Google Earth, users can use Picasa or other software to embed the digital photos in the map. With collected data by GPS tracking device, each scenic spot can be marked in Google Earth and displayed with related photos. In addition, by discussing with the local planners, it's possible to assist in scheming out the most appropriate travel routes. And according to these routes, users can create a simple animation by Google Earth's basic functions. With different angle of vision, aspect or altitude, the data can be used to produce similar form of films for users to watch landscape images or travel routes in the process of the animation. The results are shown in Figure 8, and display the name as well as location even or photos (Figure 9) of certain obvious attractions in Danei community under the animation.

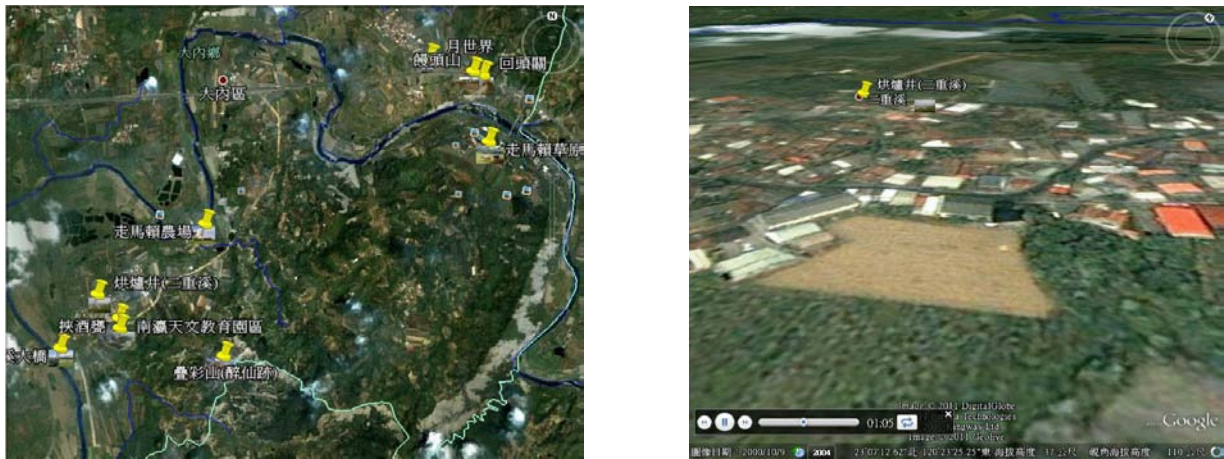


Figure 8 The animation is built in Google Earth

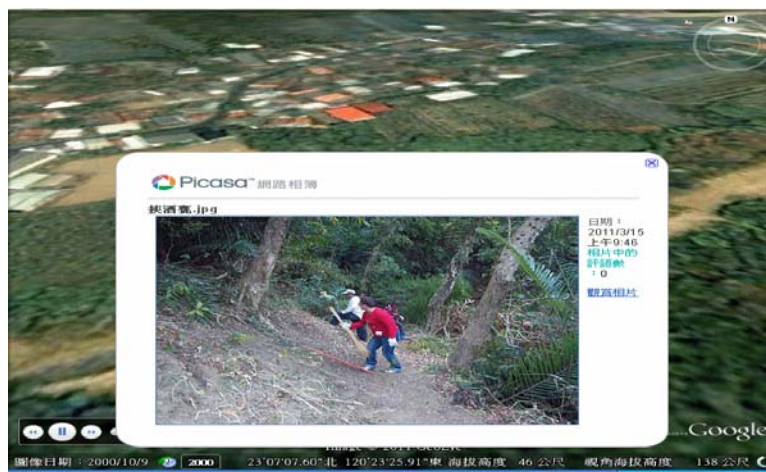


Figure 9 Photos are shown under the animation

3.2 Establishing Chiu-Shi Website

For Chiu-Shi website, it's necessary to build a management system. The system can allow managers or community planners to edit and manage the web pages. The main items in the web pages contain community introduction, traffic information, data downloading, and discussion forum. Through the management system, users are able to modify, add or remove each item, and the latest contexts will be updated to the community pages immediately. The Chiu-Shi website is shown in Figure 10a, and designed by Google Map API and JavaScript. Figure 10b is the management system. By create accounts and passwords, managers can login in this page. On the other hand, it's more import to set up the inquiry system for community resources. Figure 10c and 10d represent the inquiry system. Besides managers, all users can search for the some resources about Danei community through this page. In the inquiry management system, it also lets users to input some information and upload data such as KML, KMZ, images, or media. And through the data transformation, those information about the resources can be shown on the electronic map .

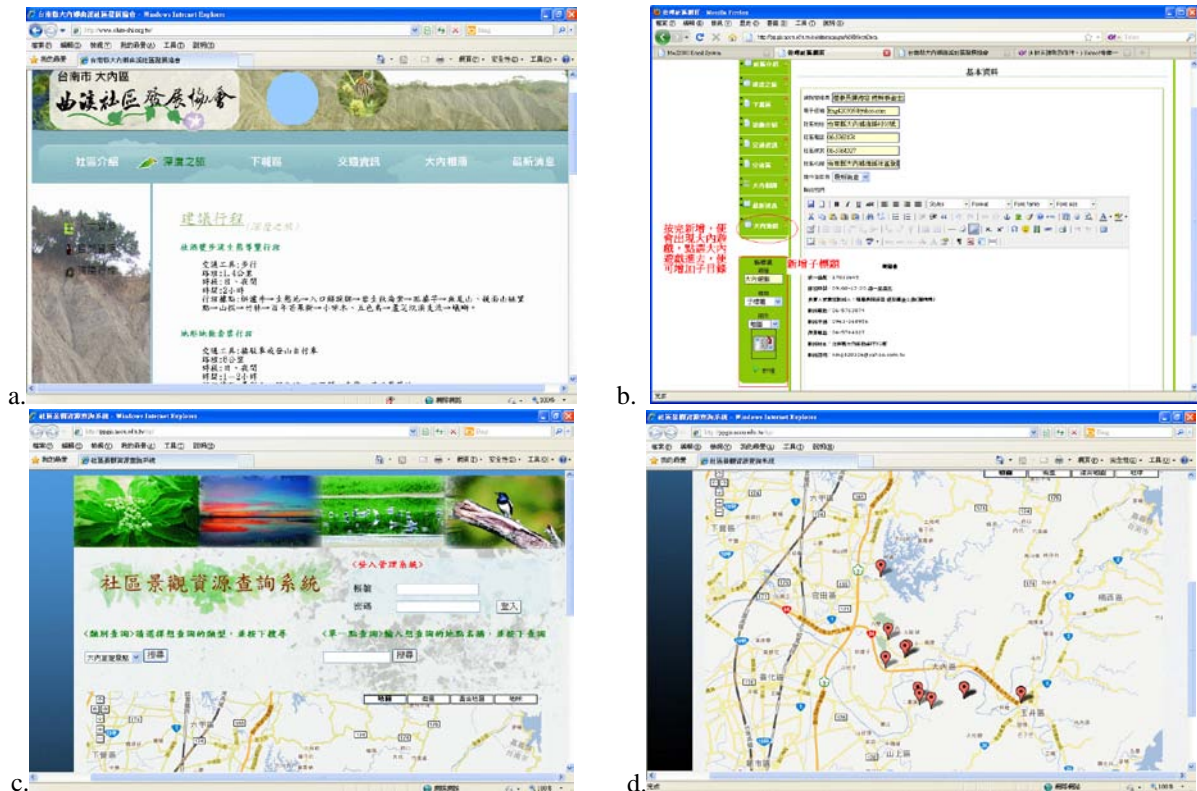


Figure 10 a.The Chiu-Shi website; b.The management system; c. and d.The inquiry system.

4. Conclusion

For the remote rural community, sometimes tourists cannot directly find out the landscape or biological resources from the general travel or electronic maps. Even local residents or managers are unable to point out the accurate location of attractions. With inexpensive GPS tracking devices, the community users can effectively record each location of resources. In addition, by using QGIS and Google Earth instead of ArcGIS, it allows users download for free via the Internet. Most importantly they also have interface in Chinese, so through the operation training, it will make local users easier to learn how to use. If necessary, GIS data may be transformed into different formats, such as shp, grid, contours, even or KML for Google Earth. Finally, by establishing the websites, people are able to view some information about geographic data on web pages, and users or managers can download or upload data from these. Therefore, the study wishes to cause more participators to understand the natural or cultures resources of local community by PPGIS, and make them unite to take part in the community development.

5. References

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