

Study of police road test system based on Embedded and GIS technology

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Abstract—Police road test system platform is based on SuperMap GIS platform, the platform front-end employ embedded devices; the background uses high-performance servers. The system main apply embedded development, GIS, GPS and wireless transmission technology to realize collection, display, query, editing, analysis, path planning, navigation, points of interest management of the base station information and its surrounding information, so as to achieve fast positioning of the mobile phone location and can respond quickly, saving handling time and improving the work efficiency. Road test system Apply component-based development, integration management of mass data, comprehensive integration of spatial information technology, and other new technologies, while enabling seamless integration with the Internet.

Keywords- SuperMap GIS, Embedded Development, Routing Planning, navigation

I. INTRODUCTION

Police road test system is a set of system to collect and manage mobile phone base stations information. How to truly realize the graphical management of the base station is the first problem. Conventional methods and techniques are difficult to adapt to management requirements under the new situation. The spatial information integration technology represented by an embedded technology, GIS and GPS is being adapted to such a request, especially the succeed development of GPS and embedded technology and equipment provide a convenient, practical, economic and technological means for the drive test system provides. Police road test system primarily collect relevant base stations information through police vehicles in the process of the daily activities, obtaining the base station information that was consistent with the public security system, at the same time combined with embedded technology, GIS and GPS technology to achieve based station visual display, analysis, and quick navigation features, providing detection basis for decision making of mobile phones criminal cases, improving the speed and efficiency of detection.

II. SYSTEM GOAL

Mobile phone base station information is most important to deal with mobile phone-related crime. The level of detail of information will determine whether the law can keep abreast of the suspects activities, and quickly arrested him. However, currently the base station information collection and management system used by the police system is

seriously inadequate, largely remain at the base of the property management phase, can not intuitive display base station, not to gather the surrounding information of the base station, can not analyze, it is difficult to meet the requirements of the police system.

Road test system's goal is to overcome the present shortcomings of the police station management system. While we achieve the collection and process of the base station and the surrounding spatial data, the data will be combined with map data, completing the intuitive and accurate display of spatial information and car navigation, path planning, analysis of base station range, spatial analysis and other functions. Ultimately you can make it easier to find the specified base station and can be quickly arrived at the designated location, saving valuable time for handling cases.

III. SYSTEM GENERAL STRUCTURES

System establishes central database and in-vehicle database based on the existing base stations and data resources, keeping database consistent through wireless copy and offline copy, on this basis, to realize the collection of handheld data resources, car navigation, graphics management and other functions. The system software consists of two parts, one is running on the embedded device, in charge of the collection of specific data, map display, navigation and other functions, the other part is running on the server, is responsible for collecting, publishing and complex analysis of the data. Firstly, embedded devices and the specific equipment is used for data collection, and then using the wireless to transmits data to the server, the server collecting, synthesis, processing the information on the screening make them required for the formation of the system. On the one hand, the data is on the web server, realizing web display and share of data. On the other hand, they were returned to the various embedded devices, implementing the visualization display of data, the route analysis, base stations navigation, voice navigation, base stations show, and analysis of the base station, base station management and other functions in the embedded devices. The system general structure is shown as below figure 1:

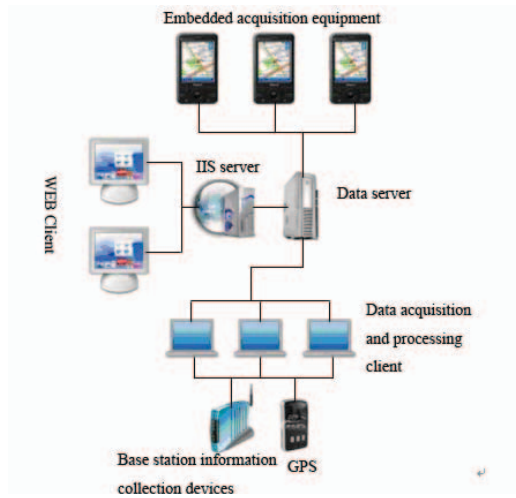


Figure 1. the system general structure

IV. SYSTEM FUNCTIONS AND IMPLEMENTATION THEORY

System main functional module is divided into five parts: information collection capabilities, geographic information system functionality, GPS navigation functions, analysis functions and web display, its main functions and implementation principle is described as below.

A. Information collection function

① Collecting current location information of data: opening up a thread for the current base station information collection, obtain the current location of the base station information from the base station acquisition device, including the base station number, cell number, name, signal strength, combined with the current GPS information, constitute the complete information on the current position points, in order to prevent an infinite collection of data, compare to collect information and the information in the database; if they meet the conditions were stored in the database, otherwise discarded.

② Acquiring the base station information from a specific device: getting the base station equipment related information using embedded devices from the vehicle dynamically, mainly including the base station latitude and longitude, number, location, and other parameter information, data transmission of in-car devices and embedded devices is mainly through Bluetooth to come true.

③ Data import: there are importing data from a server and importing data from a file, the server data can implement a button to import the data, only need to specify the server name can able to achieve a key to import the data. Because of different sources, the format of file has some differences, importing must first convert specify the format of information into Excel or Access database file, then import the data.

B. GIS Function

GIS function is completed by GIS component with the particular development tools, the main GIS functions are as follows:

① Map basic operations: including map display, zoom in, zoom out, specific ratio shows, pan, select, view the properties and other functions.

② Map editing features: the add, modify, and delete function of surface features, information points and base stations.

③ Thematic map display: the display, save and modify of a variety of specific information of different thematic maps.

④ The coverage display: establishing the coverage display model and to achieve the coverage shows, blinking function in accordance with the corresponding data.

⑤ Map output : according to the need to achieve the map output in different ways.

C. GPS navigation

① Navigation: program establish a thread to receive device constantly changing information on the GPS receiver, decomposing the required information from the received information, including latitude and longitude, speed, direction, height and other information, achieving dynamic rendering of navigation arrows and remove and display the speed attribute information using the received information on the map animation layers, while enabling voice navigation.

② Route planning: The critical points on the map generate network information, selecting the information points which may be participate in operations the entire network, realizing optimal (shortest) path analysis using Dijkstra algorithm.

③ Route simulation and real navigation: Firstly, simulated navigation calculate optimal (shortest) path, and then separate path, calculating the angle of the path of each segment and realizing simulated navigation according to its properties. Real navigation along the path can also calculate the optimal (shortest) path for the current collected points and to achieve the corrective of path functions.

(4) Analysis functions: including base stations cell analysis, overlay analysis, buffer analysis, Boolean analysis, city bus transfer analysis and support decision-making model libraries and so on.

(5) Web display function: You can use GIS components, or can be used non-GIS server combined with Ajax technical means to achieve WEBGIS functions, then to realize data sharing.

V. THE MAIN INTERFACE FOR SYSTEM IMPLEMENTATION

A. Embedded device software components

Embedded software components are developed by VC combined with SNE components, the main functions and interfaces are as follows:

① The import, display, query, location of China Unicom and mobile base stations



Figure 2. Base station query interface

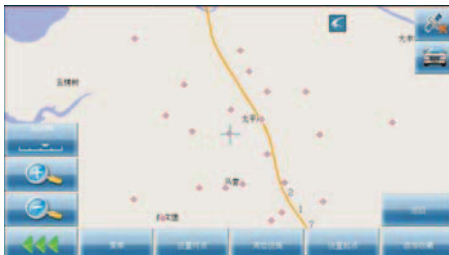


Figure 3. Base station display, positioning interface

② Path planning, the shortest path query and the optimal path query



Figure 4. Optimal path analysis, navigation interface

③ Base stations, voice navigation, simulate navigation, real navigation and correction, path navigation

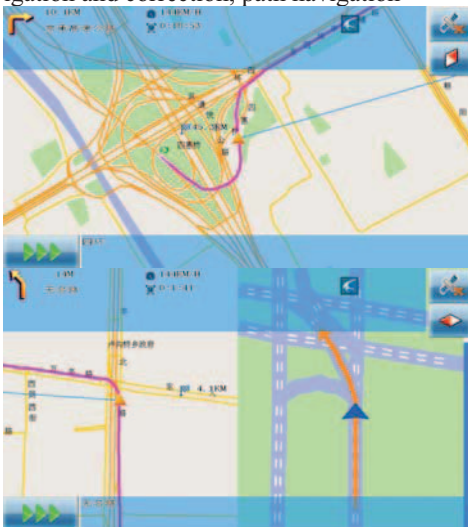


Figure 5. Voice navigation, junction zoom in display interface

B. Server software

The server is implemented by VB and Supermap Object, key functions include: import and export the base stations data, editing, base stations data editing, base stations simulation, transmission with embedded devices, gathering points management and so on. The main interface of server software is shown as below:



Figure 6. The main interface of sever software and menus

VI. CONCLUSIONS

The embedded technology, GIS and GPS technologies are applied to road test system that can solve the problems of the current management system of police security base stations, can achieve collection, management, visual display, spatial analysis, path planning, GPS navigation and other functions of the base station data. In the process of continued to collect information, the management, dynamic analysis, fast navigation, path analysis, and information point query functions of the base station information can be come true. They can provide decision-making basis for the detection of related cases, shorten the detection time, better to prevent the phone crime. At present the system has completed development and been applied to a security system, and achieved good results.

REFERENCE

- [1] Chen Shu-peng, Lu Xue-jun. Introduction to Geographic Information System. Beijing.[M]: Science Press, 1999
- [2] Jinshi Fang, Jianbang He. "The architecture and technology of grid GIS," Geo-Information Science, vol. 4, Jun. 2002, pp.36-42.
- [3] Shuliang Zhang, Guonian Lu, The network geographic information system, Beijing:Science press, 2005, pp.131-132.

- [4] Huali Zhang, "A webGIS based real estate information releasing system," Engineering of surveying and mapping, vol.11, Sep. 2002, pp. 29-30.
- [5] J. Kim, "A Web-Based Speaking Test Development Using Visual Basic 6.0," Multimedia Assisted Language Learning, vol.9, Nov. 2006, pp. 77-98.
- [6] Huang jian-ye, Wang wei-an. Group-ware Technology and Its Application in GIS.[J]: Geo-Information Science, 1999
- [7] Song guan-fu, Zhong er-shun. The Research and Development of Component GIS[J]. Journal of Image and Graphic[J], 1998, 12(5):23-25