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The Development of Tourism Navigation System in Yanchi Country Based on Wireless Sensor Network and Component GIS

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Abstract: Through the research on the application of the domestic and foreign tourism navigation system, this paper analyzed the advantages of the wireless sensor network and component GIS applied to tourism navigation system, applied wireless sensor network and component GIS to tourism, realized the development of tourism navigation system based on wireless sensor network and component GIS, provided people with a visual means of query, made the user to dialogue with the computer more intuitively, and got needed information as well as the realized navigation and positioning according to their wishes. *Copyright © 2013 IFSA.*

Keywords: Component GIS, Wireless sensor network, Tourism navigation system.

1. Introduction

With China's deepening implementation of its reform and opening-up policy, tourism gradually becomes a new economic growth point [1]. Yanchi Country is one of the important tourist cities in the west and the development of tourism promotes the local economy. That improve the technology level of tourism information is the demand of local economic development and the times [2], and the research of tourist navigation system based on wireless sensor network and component GIS has great practical significance.

This paper mainly researches and designs the wireless sensor network [3, 4] platform, completes the application function of the navigation system. Sensor network node is designed and implemented; use GPS, the algorithm and image processing knowledge to implement the function of wireless location on the CC2430 nodes independently; for the application need of navigation system, realize a complete set of system which combines wireless sensor network (WSN) and geographic information system, make the user to dialogue with the computer more intuitively, and got needed information as well as the realized navigation and positioning according to their wishes.

2. The Framework Design of Tourism Navigation System in Yanchi Country

2.1. The Principle of System Design

During the process of designing tourism navigation system, the design should follow the principles [5]:

1) Practicability.

In the system development, for the average user know little about GIS application, system interface design is friendly, and the operation should be close to the user, and meet the needs of users.

2) Reliability.

All data in the database should be accurate and reliable, the system operation is reliable, stable and correct. Ensure data system is security, the system should have strong fault tolerance and security, and does not result in the data loss and system paralysis as a result of an action.

3) Scientific and normative principles.

System should be built in the thoughts and methods of software engineering, guarantee the science, the rationality of the system structure, at the same time, the various functions of the system should conform to the actual needs. Information coding should follow the principle of information standardization, and follow the relevant industry standards.

4) Scalability and efficiency principle.

System should start from a long-term point of view, considering the extended function of the system. Reserve data input/output interface, to gradually add and update the database, have the appropriate amount in advance for the equipment capacity, computer performance index, software platform, in order to prolong the lifecycle of the system. On the basis of the successful implementation of various functions, hold good price performance ratio of system equipment, pay attention to economical and practical, deploy software and hardware system with the best cost performance.

2.2. Framework Design of System Function Module

The design System function module is one of the key factors of success. According to the needs of the system, analyze system design goal, at the same time, consider scalability, flexibility, use efficiency of the system, design the functional modules of the system. This system mainly consists of system management, navigation system, multimedia information retrieval system. System function module structure is shown in Fig. 1.

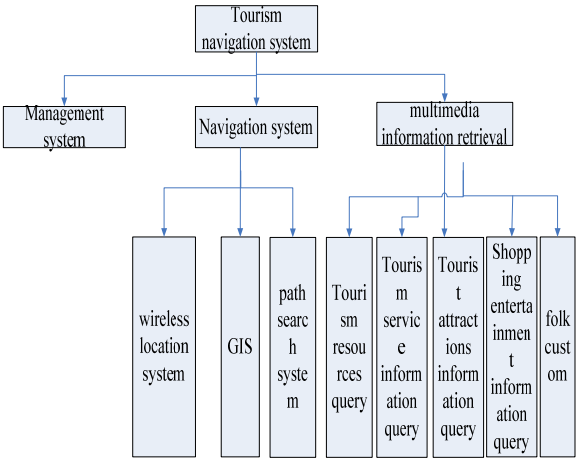

Fig. 1. The system function module structure of tourism navigation system.

3. The Detail Design of Travel Navigation System Function Module in Yanchi Country

3.1. Navigation System Function Design

The navigation system designed by the paper will insert in the whole system architecture of the wireless sensor network platform, from the function, it can be divided into wireless positioning system (GPS), geographic information system and the path search system, the following Fig. 2 is the navigation system structure based on wireless sensor network platform.

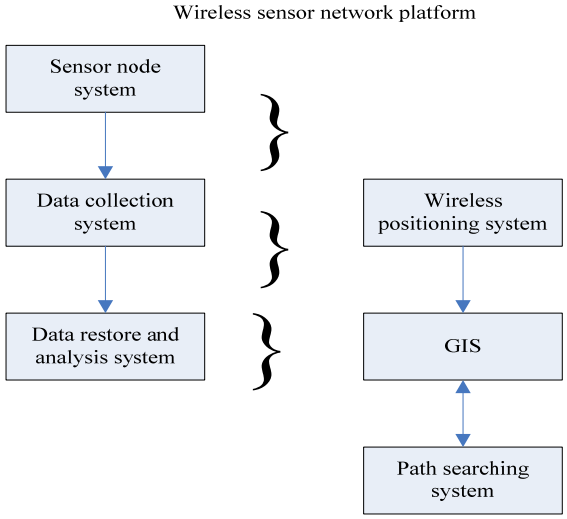

Fig. 2. The navigation system structure based on wireless sensor network platform.

According to the above system design, the overall function of the navigation system is shown in Fig. 3 which is the overall function diagram of navigation system.

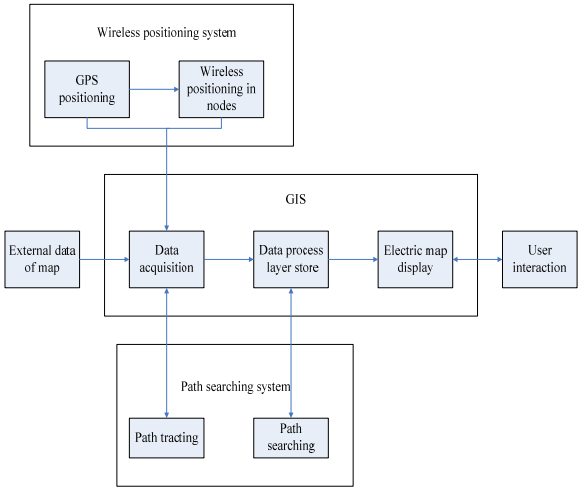

Fig. 3. The overall function diagram of navigation system.

1) Wireless positioning system, mainly collect location information through the sensor network platform of designed system of sensor nodes, and analyze the location from the data collecting system, at the same time obtain the related road information collected by corresponding node sensor.

2) The geographic information system, combine the corresponding electronic map data and location information in sensor networks, feedback the data by means of electronic map image display to the user, at the same time, the user can control the map information and the corresponding road conditions by manipulating the man-machine interface.

3) The path search system, combine geographic information system to search path, track mobile node trajectory, realize real-time navigation.

3.2. Hierarchical Display of Electronic Map

Map contains many layers, that is a collection of layers. Conceptually, each layer can be taken as a database, but it is not a common database, it includes geographic information and attribute information. The top of the map is the dynamic tracing layer, the bottom is mapcontrol, middle layer is set. Their orders decide the relationship of map control. The top layer will be to draw finally, and on the bottom of the layers are drawn firstly.

This paper wishes to establish the hash table to store data of each layer, and then according to the need display and hide a specific layer, realize the hierarchical display between the layers. The maps used in this article include: the data which is given priority to line represents road layer of urban roads; the data which is given priority to surface represents terrain layer of river lake mountain green land; the data which is given priority to point represents the layer of location information of hotel, party and government institutions, businesses, science, education, shopping malls supermarkets, medical and health care, such as bank, insurance, post and telecommunications communication. Fig. 4 is the display of total layer electronic map.

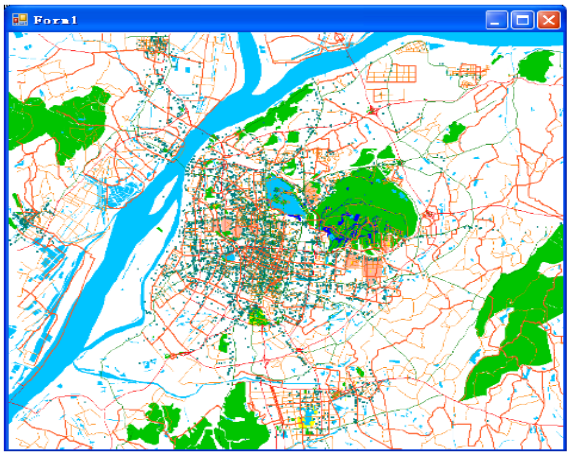

Fig. 4. The display of total layer electronic map.

3.3. The Zoom Display of Electronic Map

The user can control the decrease and increase the function of the map through the mouse wheel rotation or buttons. Map zoom is realized through block access, Fig. 5 is the data rectangular block access.

For map zoom function, analyze four pieces of the graphics area that the four directions need, then load map data of the specified area from the original layer, and then combine the data to mapping; Reduction function, take the current map data as Layer, specify the required area in the Layer to obtain map data, and then draw it. Thus realize the function of map zoom, Fig. 6 is the display before zoom function, Fig. 7 is the display after zoom function.

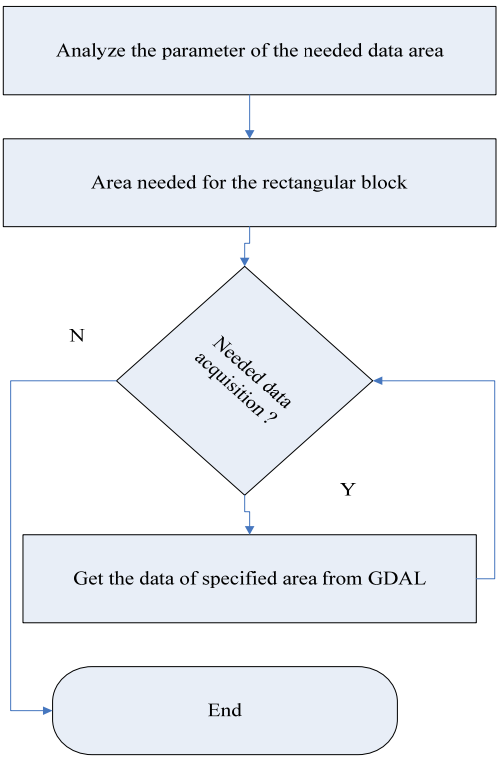

Fig. 5. The data rectangular block access.

Fig. 6. The display before zoom function.

Fig. 7. The display after zoom function.

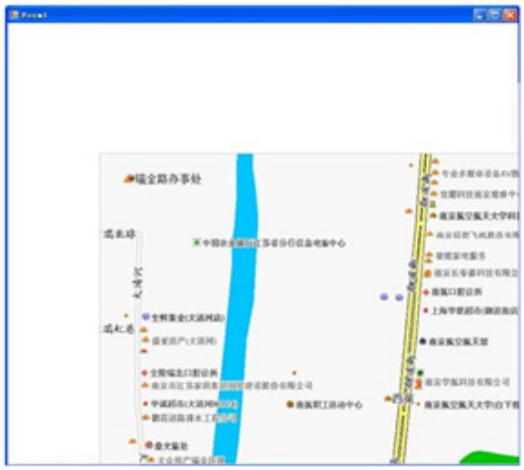

Fig. 9. The map display of translation process.

3.4. Translation Display of Electronic Map

Click map drag can move images, and will load the image data needed. Fig. 8 is the map display before translation function, the practice is to calculate some area of data needed in the map (drag process only needs two pieces of rectangular area); Fig. 9 is the display of the translation process, and then load the data of specified area in the layer, for the next drag operations, will eventually save the current map of data through the designated area data acquisition, and remove the other data. Then map the final map data through the system graphics library, Fig. 10 is the map display after translation function.

Fig. 10. The map display after translation function.

Fig. 8. The map display before translation function.

3.5. The Path Search System

Through location information from the wireless sensor network node, as well as environment, such as parameters road conditions information, for example, needs to change the corresponding state of road congestion, road information ground damage, corresponding to the GIS in [6-8]. The above process needs corresponding specific road information, and makes corresponding changes.

1) Coordinate search.

Path search function is realized based on the data of main roads layer, and road layers is only related to road information, if the search point is not on the road, you will need to locate in recently points on the path to the search path. Particular way is to take the search point in the road layer as the center, expand as an order of magnitude, explore the path information within the range expansion, once include path information, calculate the point from the search point to the road recently, and then determine the road information. The end/start settings of path search may be also not on the road, and need to process according to the above way, the Fig. 11 is the process flow diagram.

3.6. Path Tracking

Set the timer on the mobile node to make it to report the location information for base station in each set period of time, and the base station transmits data to the data collection system, so as to track the trajectory path of mobile node.

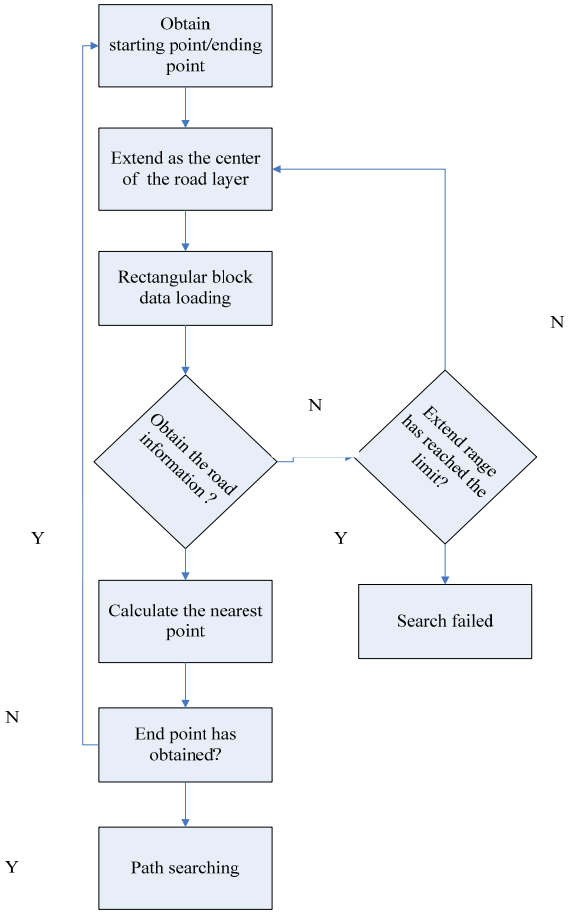

Fig. 11. The flow of the end/start settings of path search.

If the interval time of timer is longer, it cannot achieve the purpose of real-time tracking, but small interval will cause more record point, if record all the collection points, larger storage space will be used, which is shown in Fig. 12, this paper uses the current point and the former point slope compared with the last time, if the gap is in the setted range, then replace the former point, otherwise, record the current point and the slope, in order to use next time.

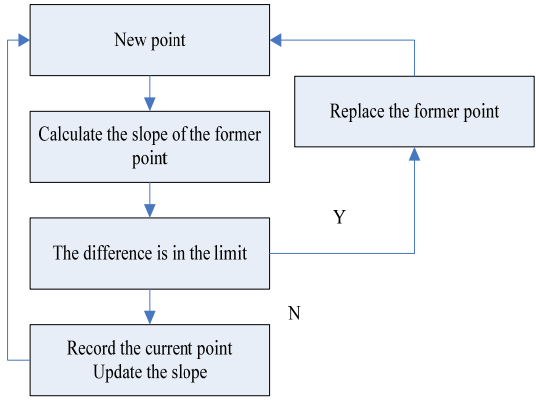

Fig. 12. Trajectory tracking record flow chart.

When nodes mobile, the image redraws the layer centered on the node will cause the layer continuously drawing, which wastes system resources. This article selects the method that set the starting point as the center of the layer, expand in four directions, expansion scope is specified proportion of the layer (e.g., 50 % of the original layer), once the nodes mobile beyond the specified scope in the layer, then translate the layer, make the point location displayed in the center of the layer, map the trajectory by this way, Map trajectory is shown in Fig. 13.

Fig. 13. Trajectory real-time display.

3.7. Multimedia Information Recall System

User can query by the way of query interaction, part of the scenic spots, travel service, the information of the local folk customs can be also obtained in the subsystem query on the interface. User inputs related attributes, the system will find very comprehensive multimedia related information for you in the database. In multimedia information retrieval subsystem, the information resources of a variety of landscape, display text, audio, video are very rich and comprehensive. According to different types of query object, tourism information query is divided into the following several parts: tourism destination overview information query: through the subsystem, the user can query to the general situation of the regional tourist area, national culture, local products information; Tourism services such as information query of catering and entertainment attractions service; Tourism enterprise organization information query; It also can check by the subsystem traffic, tourist consumption of the travel agency, hotel reception unit, and makes the tourists to prepare well before travel. A brief introduction of Yanchi Country is shown in Fig. 14:

4. Conclusions

As the increase of the people's material and cultural life, return to nature is becoming a kind of ideal, tourism industry also faces a new opportunity for development. For the development of tourism, the unique tourism resources are very important, but the tourism promotion and related quality services is one of the indispensable conditions.

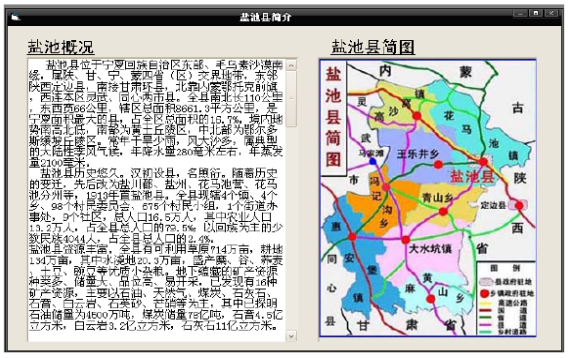

Fig. 14. The introduction of Yanchi Country.

As a new information acquisition and processing technology, wireless sensor network (WSN) has incomparable advantages compared with traditional technology [9-10], this paper mainly researches and designs wireless sensor network platform, completes the application function of navigation system, sensor network node is designed and implemented. Use GPS, a certain algorithm image and processing knowledge to realize the function of wireless location; for the application need of navigation system, realize a complete set of tourism navigation system in Yanchi Country which combines wireless sensor network (WSN) and geographic information system.

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