

The Integration of GPS and GIS in Orienteering Training Monitoring and Control System Based on MapX

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Abstract—This paper introduced Visual Basic as development platform, integrated GPS and GIS technology to develop the Orienteering training Monitoring and control system based on MapX control component and MSComm control component. This system mainly realizes the athletic field environment parameters setting, real-time dynamic data acquisition, Orienteering Athletes Training in the running state (speed, direction, position) in the electronic map dynamic real-time display and other functions. The system will help improve the scientific training in Orienteering.

Keywords:-GPS.GIS.MapX control component.MSComm control component. Serial communication

I. INTRODUCTION

Orienteering is a very healthy smart sport both physically and mentally. Because it can make people's physical strength, intelligence to fully exercise and more and more people's attention, and quickly swept the world. However, Orienteering training methods are relatively backward. Outstanding performance in the following two aspects: one is the only coach training methods according to their own experience to make training plans; athletes also rely on experience to adjust the use of directional technology and the strengthening of the training ground control to improve the training effect; on the other hand is the coach evaluation of training effect is also depend on personal observation, there is also only with video and data analysis to evaluate the training results of training, which is too subjective, the lack of essential science. In view of this, it is particularly important to develop a training environment monitoring system parameters of various field are taken into account to strengthen safety supervision, scientific training, improve game performance.

GPS is a global, all-weather, continuous satellite wireless positioning system, such as position, speed can provide 3D real-time spatial information and the time information of the high accuracy. It has high positioning accuracy, fast speed, no clouds, forests and other ambient occlusion anti-interference characteristics and security performance, can realize the navigation and positioning of moving target on the vehicle, ship, the running man.

Geographic Information System (GIS) is a recently developed a devoted to emerging scientific management of geographic spatial data, the support of computer hardware and software, acquisition, management, operation, analysis,

decision-making and the output of the information system of spatial data and attribute data.

Based on the above analysis, this paper by means of high precision positioning characteristics of GPS for moving objects, as well as the GIS graphic display function and the function of data analysis, developing Orienteering training Monitoring System.

II. THE DEVELOPMENT OF GIS AND THE DEVELOPMENT MODE

Development of GIS software patterns experienced function module, package type software, core software, and then to the component GIS and the World Wide Web WebGIS. The current GIS application software development there are three main models:

(1)The data structure and database independent design of spatial data, using visual programming languages (VB, VC++, DelPhi) to develop a commercial GIS product, this method demands for scientific research and scientific research funds is relatively high.

(2) The purchase of commercialized software platform at home and abroad advanced (MapInfo, A, rcInfo, ArcView), using a development tool provided (MapBasic; AML, Avenue) were developed, this method is simple, but its poor transplanted, and by the development tools limited.

(3) By using the GIS component and object-oriented visual programming language integrated two development modes. This development mode allows cross-language application, it makes the GIS software has good configurability, scalability and development, development becomes more convenient, often used by developers.

MapX is a powerful map analysis function of the ActiveX control to the users of the products of MapInfo company. It is the standard controls based on the Windows operating system, can support most standard visual development environment such as Visual C++; Visual Basic; Delphi Power Builder. The programmer can choose their most familiar with the development of language in the development process, easily map function is embedded into the application, operation and can be separated from the MapInfo software platform. Using MapX can simply and fast implementation of embedded map function in the application, to enhance the enterprise applications space analysis ability, realize enterprise application value. MapX uses the same map technology based on the MapInfo

Professional, it can realize most of the map editing and spatial analysis functions of MapInfo Professions with. A variety of tools, attributes, MapX provides methods that implement these functions is very easy.

III. THE MAIN FUNCTION OF MONITOR SYSTEM OF ORIENTEERING TRAINING

The system uses GPS technology, GIS technology, wireless data transmission technology and serial communication technology to realize the real-time detection and monitoring the actual running route of athletes. It also has provided the venue environment parameters, remote real-time dynamic data acquisition, the game target, starting and finishing line setting, beyond the competition area alarm, running track storage and playback, the actual running routes and advance planning optimal route correlation function. In addition, the system has the basic functions of the electronic map in the middle, zoom, roaming, ranging.

IV. THE INTEGRATION OF GPS AND GIS TECHNOLOGY

In the actual development of the geographic information system, in order to realize the integration with GPS, GIS systems must be able to receive the GPS receiver to send data (usually communicate through the serial port), and then process the data, including the extraction of the navigation information, common with latitude and longitude, time, speed, azimuth angle and conversion of data, finally all kinds of operation, the dynamic coordinate data display and data storage is its basic function. Figure 1 describes the system structure model of integrated GPS and GIS.

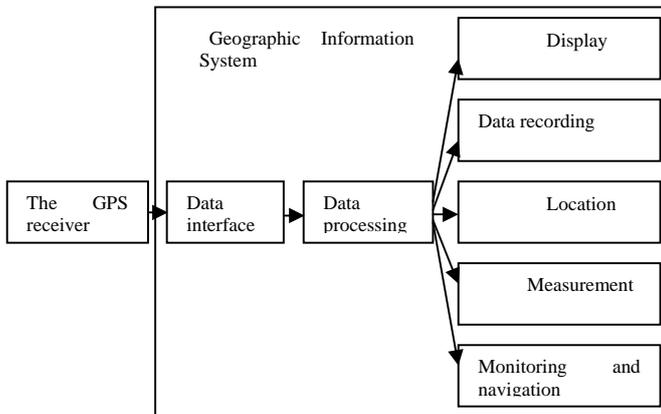


FIG.1 THE SYSTEM STRUCTURE MODEL OF INTEGRATED GPS AND GIS

A. The MapX control component loading

In practical application, MapX must be installed in the system. As long as the Windows 2000 /XP operating system installed MapX, can load MapX control. Select the "Engineering" "parts" from the menu, select Map-InfoMapX in the parts list, and then click on the "application", "set" button, globe shape of the MapX

control is loaded into the toolbox.

B. The MapX control and MSComm control property attribute settings

In the design phase will insert MapX controls, MSComm controls to the form, because the MapX control is used to display the electronic map, so it should be placed in proper position of the application form, the appropriate location for the main interface in the application of the electronic map display. The following code implements property of the MapX control common settings.

```

Map1. AreaUnit=14-m Unit SquireMile
Map1. CurrentTool=1000-m iArrowTool
Map1. CenterX=120.35042417153
Map1. CenterY=36.056529799309
Map1. EditableLabels=true
Map1. height=8415
Map1. MapUnit=0-m UnitMile
Map1. Rotation=0
Map1. visible=true
Map1. width=11415
Map1. Zoom=1.97123
  
```

The MSComm control because the runtime does not display on the electronic map, which can be placed anywhere in the application form. And its program (set the attribute, method calls or respond to events), so as to realize the communication of wireless receiving module and the computer. Common property of the MSComm control program code is as follows:

```

MSComm 1. PortOpen=True
MSComm 1. Commport=1
MSComm 1. Inbuffersize=1024
MSComm 1. Inputlength=0
MSComm 1. Outbuffersize=1024
MSComm 1. Rthreshold=60
MSComm 1. Settings="1200,n ,8,1"
  
```

C. The creation of electronic map

Create a MapInfo map is the process of establishing map layers and MapInfo table. New layer according to the demand to build, can establish a reference by raster image directly buy MapInfo map or registered, can also be obtained by scanning a raster image registration is not registered as a reference. The raster image is only used to display raster layer, but not as vector layer that give them additional data and stepless zoom, so if the raster image as a reference, you must first vector of its. Making vector map in a variety of ways, usually on paper maps were digitized or raster map as the basic map by means of digital instrument, use the mouse to handwork vectoring "digitization" on the screen, vectorization can also use professional vector software Raster2Vetor to realize the raster image.

D. Importing electronic map

Loading electronic map requires multiple layer to open with GeoSet map management environment, users can change the "default" to meet their own needs. GeoSet set includes a projection, the default zoom value, automatic

annotation objects, zoom range and the open table is visible. Set up later, to specify a file name (.gst extension), save it to the MapInfo\MapX \map directory, and then click MapX control in the application form, attribute set on it, set the GeoSet property to the generated GST files can complete electrical import sub maps. This example is the use of GeoSet in Yichun city of the MapInfo electronic map of each layer cut open, generate Orienteering.gst according to their requirements into the MapInfo\MapX\map directory, and then modify the properties of the MapX control, import the GeoSet property is set to Orienteering to complete the map.

E. Operation of electronic map

GIS application software asked to see the graphics to various scale, such as small scale view global view, local in scale, view details to large scale. So we must provide a user such as zoom, centered and roaming. Using MapX universal tool, can conveniently realize the function, and the use of the code a little. The concrete realization of the code are as follows:

Zoom in: Mapl. CurrentTool=miZoomInTool
 Zoom out: Mapl. CurrentTool=miZoomOutTool
 Middle: Mapl. CurrentTool=miCenterTool
 Roam: Mapl. CurrentTool=miPanTool
 Rang: Mapl. Distance(x₁,y₁, x₂, y₂)

For each part of the application main window in the loading is completed for easy browsing of electronic map, the tool can be set MapX for roaming, as long as the application's main form of Form_Load () event can join the Map1. CurrentTool =miPanTool statement.

F. Access to GPS data

(1) Communication Orienteering Athletes and training monitoring center

For the moving target GPS centralized monitoring cannot do without communication channel. Location data is received by the GPS device by means of communication is transmitted to the monitoring center, the data transmission is realized in several ways: ① owned radio; ②the GSM short message function of a mobile communication; ③using mobile communication GPRS or CDMA network data transmission mode.

CDMA wireless high-speed data services industry application relies on the CD-MA 2000 1 x network, through the PDSN wireless access to the IP network, the wireless data transmission. The GPRS service provides the "one-to-many" service, namely a plurality of GPRS wireless terminal (DTU) sends the data to a fixed data processing center. GPRS is based on the transmission of data in the protective bag, when the GPRS wireless terminal access to GPRS network, it will automatically attached to the Internet, so as to carry out data transmission.

Whether using GPRS or CDMA data transmission mode, although in transferring large amounts of data quickly, but have to rent commercial network, in addition to the burden of the cost of the network and terminal expenses, and hardware maintenance also spend a certain cost. The data transmission speed is relatively slow with GSM network of

short message in the form of SMS, easy to produce congestion. Especially the "point to point", the mode of transmission, the delay is longer, usually in more than 10s, and the monitoring center of SMS communication module, data processing ability is low. In the real-time case, very difficult to achieve the object being monitored and the monitoring center display synchronization. Here is the first way, which is used for digital radio, using GPS global positioning technology, and through the implementation of wireless data transmission technology has been tracking the data communication between computer and target, to achieve real-time transmission and receiving of GPS data. Figure 2 is the schematic diagram of communication training venues and training monitoring center.

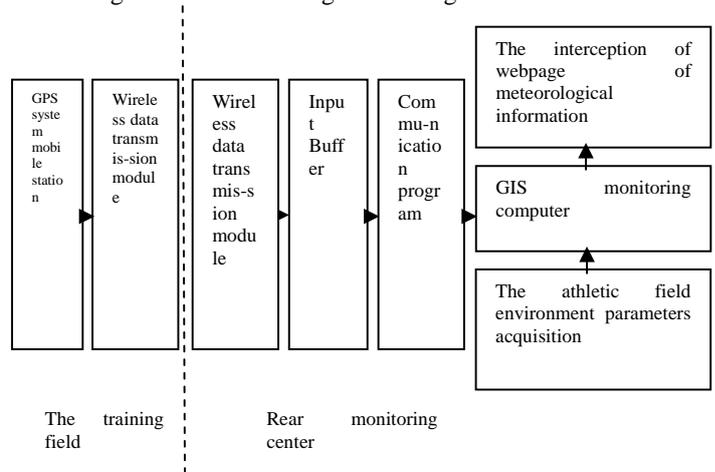


FIG. 2 COMMUNICATION BETWEEN THE GPS MOBILE STATION AND THE MONITORING COMPUTER

(2) Intercept the motion information of Orienteering Athletes

Read buffer, the content of timing in the send buffer to a string variable, and then from the string to intercept the latitude and longitude data. Because the GPS receiver adopts NMEA-0183 standard data format, to identify the different information according to the change of each prefix, such as "GPGGA", "GPGSA", "GPGSV", "GPVTG", the specific use can use instr() function to determine the specific prefix in the read a string position, then use the mid() function to read from the string in the related information and data, and according to the different receiver set different read buffer time interval. The following code introduced the extraction of longitude and latitude information read from the string:

```

Instring= MScConn 1.Input
Instring1="GPGGA"
I= instr(instring instring1)
long i=Mid(instring i+18, 10)
lat=Mid(instring i+5, 9)

```

Other dynamic information such as time, ground speed, direction angle intercept is the same, here no longer.

G. Orienteering athletes in real-time, dynamic display on electronic map

When the communication port initialization, baud rate selection and implementation of serial port settings (in this case through the dialog box in the form of initialization), GPS data will be sent to the buffer to receive the computer serial port, the buffer data read by using the menu command "training began" done in conjunction with the timer program. When you click the menu command "training began", the serial port open, and the timer Timer 1 initialization and start the timer. Realization of program code is as follows:

```
MSComm 1. PortOpen=True  
Timer1. Interval=1000  
Timer1. Enable=True
```

In order to make the motion state of athletes, including the longitude, latitude, speed, direction of movement, the real-time dynamically in the electronic map in a graphic way to visually display, attribute set Annotations we use the Map object (Map Annotations attributes) to add annotation in the form of electronic map on the display to complete graphical athletes display, realization is based on the longitude and latitude information from the serial port to read in athletes, in the corresponding place on the map in a graphical way to label. Through the timing function of timer control to realize the dynamic display of athletes, with the data of GPS motion recording Orienteering Athletes information continuously to the computer, by matching with the electronic map, the training of athletes will be monitored dynamically and in real time, in the electronic map display. The following code to achieve the Orienteering Athletes with a dot in the form of electronic map display:

```
Map1. Default Style Symbol Character= 35  
Map1. Default Style Symbol Font Size= 8  
Map1. Default Style Symbol Font Color= vbRed  
Map1. Annotations Editable=True  
Map1. Annotations Add Symbol d1, d2
```

V.SUMMARY

In the software development and application of geographic information system, using component GIS software development is the inevitable trend of future development, embedded with ActiveX control in the visual development language of VisualBasic platform based on object, makes the development of geographic information system is more simple, quick and efficient, it can give full play to the advantage of management of map data, and enables developers to quickly build friendly user interface. The development of this system aims to provide guidance and help for Orienteering Training, improve the training effect. At the same time, the system can also be applied to canoeing sports, salvage, smuggling, exploration and fishing boats, ships, ship navigation positioning and navigation, with the development of economy, need monitoring, navigation and positioning of the moving targets will be more and more, the system will be there are more and more broad prospects.

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