

GIS application based on wireless Internet

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Abstract: As an edge subject ,GIS (Geographical information system) is making its way at all times. Network and wireless communication are two technologies which can not only bring the new opportunities and challenges to GIS but also solve some key problems relating to the development of GIS, Mobile GIS , based on the wireless INTERNET , will become the new branch of GIS and bring the GIS into a brand new world.

With the technology of Wireless INTERNET, people can breakthrough the restrict of time and space and make full use of the Internet as they wish , and enjoy the advantages from the Internet. The character of Wireless Internet need the personalized information based on geographical information. Geographical information service is one of the most important parts of the wireless Internet. Mobile GIS makes geographical information as carrier and integrate all kinds of information and implement the dynamic updating of information. So mobile GIS will make GIS applied widely and become one of the popular tools for the public .

Compare with traditional GIS, Mobile GIS based on wireless Internet has many new functions . Because the handheld device for wireless Internet has function of telecommunication, it differs from to personal computer that people often used in daily life . People can use handheld device anywhere , anytime to access any information they wanted. That will meet the increasing demand of geographical information in information age. More and More scholars realize the importance of the integration between geographical information and wireless INTERNET and start the research and application of these field.

After a systematic analysis to the INTERNET and wireless communication technologies and the related products ,the strategy of applying these two technologies to the mobile GIS and applying prospect are presented. This paper focuses on how to integrate the GIS and wireless communication and INTERNET into handheld device . The whole frame of the system is put forward along with system development which based on it is finished .At last , the system is verified

Key words: mobile GIS , wireless communication ,Internet ,handheld computer

Introduction:

With the coming of the new century, people can feel the shock and the impact from the revolution of the information technology. Without doubt, information technology will make a great progress in the 21st Century, and it will make a great change in the way which people work and live. It also has deep impact on the development of the future science and technology. At the same time, technique innovation will become a vital part of the technique advance for the new century. The technique integration will become the mainstream of the technique innovation, and many subjects will develop to a higher level by the technique integration.

The appearance of Mobile phone break through regular connection between the location and the communication tool, and the appearance of the Internet make people get information resource easily and break through the barrier from the space. Mobile phone represents the trend, which indicates that the communication will become more personalized, and Internet represents the development trend of information. The combination of these two technologies will have deep impact on the communication market. To the spatial information science, the appearance of the mobile Internet is a good opportunity. Geographical information always serves for the specialized field. Although the support of the geographical information is needed, there is not a way that can make it serve to the public. The appearance of the mobile Internet makes it possible. At the same time, mobile Internet also needs the support from geo-information especially for the location information so as to exert its own advantage.

The union between the mobile Internet and the geographical information especially for the location begin to become a new hot pot of the application on the mobile Internet. Location-based Service is a kind of service which bases on the wireless INTERNET. It consists of three parts: locating technology, wireless data transmission and mobile GIS. Basing on the geographical information, mobile GIS integrated all kinds of the information of the society, so it becomes the foundation for other information technology to apply. And mobile GIS break through the limit of the application. Mobile GIS can apply not only to the professional field but also to the public. No matter the government, carrier companies for mobile device and content provider look the location information services as a new direction to develop.

Federal Communications Commission of the United States adopted a piece of regulation in 1996, it requires all of the carrier of the mobile network offer location information for the "911" emergency call. FCC also require all the location service for "911" call should control its error into 125m before October 1, 2001.

Many of the information technology companies make the union of the wireless Internet and the spatial information as the new research emphases. Microsoft bring up the "Microsoft .net" plan, it will make the hand phone and PDA access the information anytime, anywhere (reference 4). Most of the GIS companies make their own products to support the mobile Internet, including the ArcPad from the ESRI, MapXtend from MapInfo and IntelliWhere Genie from Intergraph. MapInfo and Intergraph bring forth their own solutions in detail. (reference 5,6,7)

In another important field, Mobile-commerce, spatial information has its unique function. Under the mobile environment, the spatial information is necessary to both the content provider and the customer. With the location information, the customer can get the best personalized service. Content provider can get the general information of the customer. It will become the important reference to make a plan for market.

In general, geographical information will become an important part of the mobile Internet. With the development of mobile INTERNET, there will be a higher demand to the location service. The paper will make a further analysis to the possibility of the integration of the geographical service technology and the mobile Internet technology, emphasizes on the discussion of mode and method of the technique integration .

1. Technology Possibility

- The development of the telecommunication

Telecommunication technology is one of the most important technology which support the modern society.. The mainstream telecommunication technology used by most of the countries belong to the second generation technology . It includes the GSM 、 PCS and so on. It can afford data service through WAP or SMS technology. But its speed is a problem, only 9.6k per second. Now most of the countries in the world are updating their telecommunication system. GRPS (General Package Radio Service) belong to transition technology. It can support WAP and attain 115k per second. The third generation product will become mainstream in 3-5 years. It will have better bandwidth , It can translate 2M data in a second. It will break through the limit of the bandwidth , and it makes it possible to apply many resources required applications.

- The achievement of spatial information technology

Since the its appearance in the twenty sixties, GIS is always the active subject of the geographical science. With the high developing speed of the hardware and software, especially for the development of Internet, GIS become a new generation system with the ability of seamless integration and component based.(reference 2) It makes the application service on the web come into reality. The combination of the GIS and the wireless Internet make a new way to collection, exchange , share and publish the spatial data. It will become a new development direction of the GIS and make GIS become a mainstream technology of the information technology age.

- The progress of Location technology

There are many ways to get the locating information of the wireless device. We can separate them into two parts , one based on the station of the telecommunication network , the other based on the wireless device. Both of them have their own advantage and disadvantages.

As for the technology focused on the station, its theory is to make sure the location of the mobile phone by the muti-signal from the different station. If we know the speed of the light and the time to send the receive the signal, the location of the wireless device can be calculated.

Global positioning system is another technology used widely, which based on the wireless device. There are 24 satellite server the system If any three or more of them can be seen by the location of the wireless device , the location can be calculated through the time differences. There are also many ways to improve the accuracy of the locating technology.

2. Basic Framework

General

There are many technologies to implement the spatial service based on the wireless Internet. The main differences of these methods are data organization and transfer. We can divide them into three groups : based on XML technology ,based on text data technology and based on simplified standard of the HTML.

- WAP or GML(based on XML)

The Wireless Application Protocol (WAP) is a set of open, global protocols for developing applications and services that use wireless networks. The WAP protocols are mainly based on already existing Internet protocols, but are optimized for mobile users with wireless devices.(reference 10).And WML is the tool for programmer to program for WAP. Since WML is actually an application of XML (eXtensible Markup Language), the syntax reminds of XML, with it's strictness. And GML is another developing language which based on the XML. GML is an extension to the Geographical information from the XML. Both of the WML and GML are suitable for the mobile device ,such as mobile phone, PDA and so on. Both of them need reorganization of the spatial data. But they can afford enough ability to represent the spatial information by graphics , image, text and so on. And WAP is supported by most of the company involve in the telecommunication. WAP is a open standard, it will get the benefit from this character. WAP can base on the GSM ,GRPS even 3 Generation. So it will have a good future.

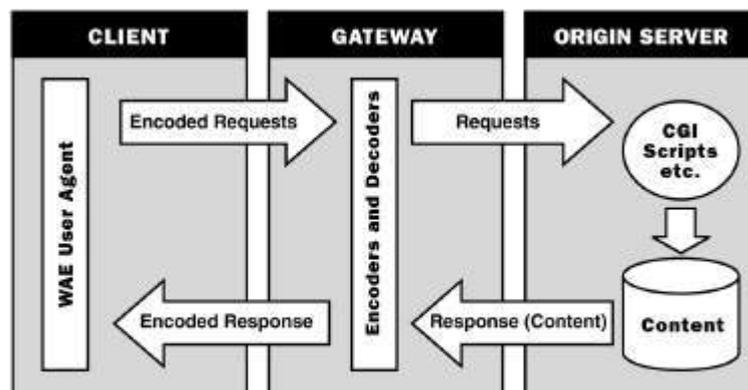


Figure 1: The WAP Programming Model

The framework of the WAP consists of three parts: WAP gateway , WAP mobile phone and WAP content server.. It will not work without any one of them. It is the gateway that connects the telecommunication network and the Internet. There are a lot of information on the WAP content server, and it can be accessed by the WAP phone. Figure1 show the basic framework of the WAP. After the customer input the URL , the signal will reach the WAP

gateway in WAP mode through the telecommunication network. Then it will be transferred into the HTTP mode in the WAP gateway. The translated data will send to the WEBSITE in the INTERNET. After the handling by the WEBSITE, the information will send back through the WAP gateway.(reference 12)

- SMS or ReFlex (based on text data)

SMS(Short message service) is a kind of data transfer technology based on the GSM ,and ReFlex is the standard of the double-call system. Both of them can be used to transfer the simple text data.

SMS is another data service based on GSM. It is different from WAP technology. Because the data transferred is limited and only text data is available. But this service will not occupy the communication channel , so it will be cheaper than the WAP technology over GSM.

No matter SMS or Reflex can broadcast to a region. That is another advantage of these two technologies. But both of them can not transfer the image or graphics which is important to the spatial information. If the simple data is enough , these two technologies are competent. In fact , these two technology are the mainstream in many countries.

- Base on IMODE or WEB-clipping(based on the simplified html)

Now ,most of the WEBSITE developed by the HTML .But the HTML is not suitable for the wireless device. Is there another way to use the resource from the wired INTERNET. We can use the IMODE or WEB-clipping technology. Both of them can support complicated content , such as graphics or image. But they are not the standard of the mobile Internet.

As for the mobile INTERNET , IMODE is the most successful technology . It is created by NTT.COM. This technology use the package-transfer technology , it means that the customer will pay for the data , not the time. CHTML is the language to develop for the IMODE. It is a subset of the HTML. So It is very easy to transfer the content from the wired INTERNET to wireless INTERNET.

Web clipping is created by Palm, Inc. and included in the Palm OS platform . Web clipping is supported through either built-in or add-on features by every Palm Powered handheld. Web clipping optimizes HTML, a universal presentation language, for display on small handheld screens.

The architecture for web clipping includes a client-side Web clipping application running on a Palm Powered handheld, a proxy server and a content server. The client-side application is constructed in HTML and translated into the Web clipping application format, which is a sub-set of the HTML 3.2 standard. The proxy server handles translation between the HTML on the content server and the Web clipping HTML subset that the handheld understands. (reference 11)

3. Key technology

- telecommunication

Spatial information service has its own way to organize and manage the data , such as the graphics , images and so on , so there will be a higher demand of the data communication . The telecommunication technology developed very fast. Many technologies have ability to transfer data such as the WAP, IMODE or SMS. It is necessary to find a way to adapt to the most of the current technology. In short , there should be a universal platform which can afford spatial information in most of the mainstream technology. For its open character , WAP can support SMS now . And this protocol will support IMODE and other technologies in the later version.

- locating technology

For the mobile device , its location is constantly changeable . So it is necessary to make sure its location on time .How to improve the veracity is another key problem. Although the GPS is a widely used technology, there are many limits for this technology, especially in the city. The technology based on the wireless network is a new trend for the locating technology. Multi route and loss of the signals are two key problems to the locating technology for both of the two technologies.

- the organization of the spatial information

Spatial information service develops with the relevant technologies such as computer , cartography and so on. In the daily life, spatial information is required in many situations. Different department has the different demand to the spatial information. Spatial information service can apply to these fields such as security department , traffic department , tourism department and mobile commerce.

The advantage of the mobile GIS is that its public information based on the geographical information. The integration of the different information should become the key problem of the research. Good way of the information organization will help user to access the necessary information as soon as possible. For the limit of the bandwidth , the data transfer also becomes a key problem of the research.

4. System test

- 1) system design

We apply the WAP and the ASP technology to implement the spatial information test. We select Microsoft's NT4 as platform to develop program. And we use to toolkit of the UP.COM and NOKIA , Microsoft's Interdev and MapInfo's MapXtreme for NT to finish the development.

Because the limited ability of the wireless device, we focused on the server-side function. All the functions are tested in the simulator.

- 2) system function

- map browse

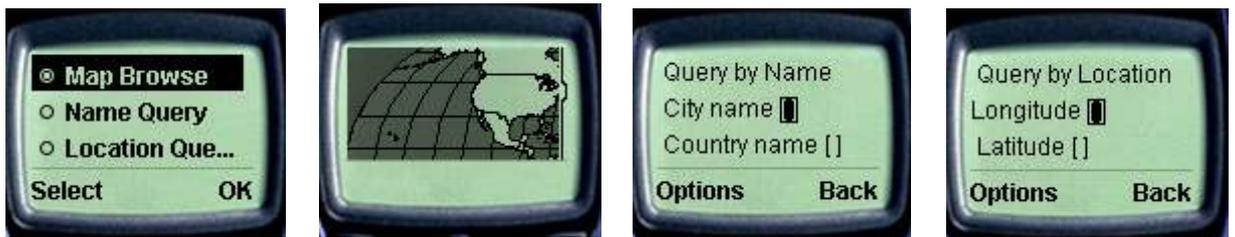
zoom in, zoom out and pan on the map

- query for location

- query with spatial location or the name ,and represent the result on the simulator.
- wireless data transferring
transfer data with WAP gateway.
- personalized the information
setup the information you have interest in
- real-time locating information
get the locating information with GPS, and pass it to the web server.

3) result

We can test it on the simulator of the NOKIA.



These pictures are the parts of the test result.

5. Conclusion

With the development of the relating technology , Mobile INTERNET will become the mainstream of the society. Spatial information service will become kill-app of the mobile INTERNET. Without doubt, It will change our life.

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