

A NEW FRAMEWORK OF LOCATION-BASED SERVICES IN MOBILE INTERNET

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Abstract: The location-based service has become popular and many services have been proposed. They can meet the needs of a wide range. However, the existing service has many problems and so affect the user experience. This paper proposed a new framework of location-based service and can improve the user experience.

1 INTRODUCTION

Location Based Service, LBS for short, is some kind of value added service, which could get the location information (geographic coordinates, for example) of the mobile end user through the radio communication network (such as the GSM network, CDMA network) or external positioning (such as GPS), and provide the users some service with the support of GIS (Geographic Information System).

2 THE DEVELOPMENT OF LBS

2.1 The History of LBS

Location-based service is not a recent service, and has been developed at home and abroad for many years, only recently with the development of the mobile Internet, LBS services become much popular.

In the U.S., Sprint PCS and Verizon, respectively, in October 2001 and December 2001 launched a location service based on GPSONE technology and used this technology to meet the FCC requirements for E911 Phase II (Kexian, 2000). According to the survey, about 2/3 of U.S. consumers are willing to pay a monthly fee to get the boot driving the direction and location information. Driven by the market, Sprint PCS, who was in leading positions in the E911's in September

2004 launched the LBS business services.

In China, CMCC in November 2002 opened the first location of services, such as the service of Monternet brand, "Where am I", "Where are you" and so on; in May 2009 and opened a service of Fetion brand "Location Services", "location dating", etc.; In 2003, China Unicom launched the service of "the star of location" on its CDMA; while China Telecom and China Netcom seems to had seen the prospect of LBS, and was about to launch the LBS in the PHS .

2.2 The Status of LBS

Currently, LBS has become a very popular mobile Internet service. In foreign countries the current leader in the field is Foursquare, some other sites are Gowalla, MyTown, Loopt and Yelp, etc; the representatives domestic LBS website are "wanzhuansifang, "jiepang", and so on (Xiaodong and Mengquan, 2003).

Currently, the popular worldwide LBS services could be divided in five categories:

Type I Latitude: focus on the share of position information and related services between the acquaintances, friends. The similar domestic application are "linxun", "beiduo", "tuding, etc.;

Type II Foursquare: the LBS combined with check-in, which is the mainstream. Domestic applications are "wanzhuansifang", "maopao", "kaikai", and so on;

Type III MyTown: the integration of Foursquare check-in and online games, the typical domestic application is 16fun;

Type IV Getyowa: precise location-based information to promote the commercial consumption, the domestic application are public comment, money bank, etc.;

Type V Group Tabs: the integration of location information and group purchase, the typical domestic application is lashou net;

In this paper, on the base of tracking and researching the mainstream mobile LBS business, the mobile LBS background and driving force, functional components, business characteristics, the faced challenge is analyzed

3 THE BACKGROUND OF LBS

With the maturity of 3G technology, business and the development of broadband mobile networks, mobile communications and Internet technology becomes more integrated, the mobile Internet era has arrived. Future mobile Internet applications have user-centric, sea quantitative, long tail and personalization features. On the other hand, global scale, iPhone, Android, Symbian and other shipments of smart phones has increased enormously in recent years, the smart phone market share climb even further. Smart phone embedded GPS modules gradually become the mainstream market, with the GPS modules speed, direction and two-dimensional and even three-dimensional space position information can be obtained, it is not just the benefits of navigation, and other basic characteristics of the location related services gradually rise, and get populated with more and more people of all ages (Shuai et al., 2010).

4 A NEW LBS FRAMEWORK

Until now, many frameworks have been released, the paper provides a new framework, this framework consists of the following functional components: (1) Location Acquisition System (2) LBS Management (3) Information Delivery System (4) Geographic information system (GIS) (5) Service delivery system .Figure 1 shows this framework.

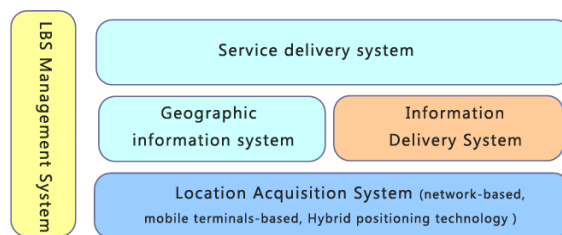


Figure 1: the framework of LBS.

4.1 Location Acquisition System

It is mainly through the positioning technology to get the exact location of mobile customers, where location data is the basis LBS system. Positioning technology is divided into the following three categories (Bin and Xiaobai, 2006):

- 1 Network-based positioning technology (reverse link positioning);
- 2 Positioning technology based on mobile terminal (forward link positioning);
- 3 Multi-system hybrid positioning technology.

Network-based Positioning Technology

In network-based positioning technology, the main function of the location calculation is realized by the networks. Commonly used network-based positioning technologies are COO (Cell of Origin), AOA (Angle of Arrival), TOA (Time of Arrival), TDOA (Time Difference of Arrival), E-OTD (Enhanced Observed Time Difference), AFLT (Advanced Forward Link Trilateration). Due to limited space, this article describes only the most commonly used COO.

COO location technology originated in the cellular positioning technology, through the collection of the mobile terminal identification number (Cell-ID) to determine the user's location, its accuracy depends on the radius of the base station area where the terminal in. The advantage is no need to change the mobile terminals and networks, and is the most economical. The disadvantage is low accuracy, especially in CDMA base stations covering a wide range (Xin, 2008).

Location Technology based on Mobile Terminals

Satellite positioning originated from the U.S. military. Russia's GLONASS, Europe's Galileo and China's Compass Satellite System are following. The U.S. GPS was undoubtedly the most widely used system. GPS location technology is like this: The mobile phone needs to receive more than 4 GPS satellite signals the same time, the satellite navigation message demodulation, with signal delay

mobile phones get pseudo-range to each satellite, with all these information it is able to calculate the exact location of mobile phones, and the use of differential techniques can improve the accuracy to 20 meters level. GPS can be achieved within a global all-weather, continuous real-time for the user to provide accurate position, velocity and time information. But there are some disadvantages such as the cold start of GPS receiver takes long, positioning consumes too much power, the poor signal in city with skyscrapers and indoor areas can lead to poor positioning.

Hybrid Positioning Technology

Hybrid location positioning technology is a direction, which combines the terminal-based positioning technology and network-based location technology advantages, so that it is more accurate and reliable. Qualcomm GPSONE technology which uses its unique patented technology, is currently the highest performance hybrid location technology solutions. It combines wireless assisted GPS, and advanced forward link triangulation (AFLT) achieve high-precision, high availability and high speed positioning. When these two kinds of positioning technology are not available, GPSONE will automatically switch to the Cell ID positioning method, to ensure the success rate of localization. The mobile station using GPSONE technology collect measurement data at the same time from the GPS satellites and CDMA networks (Feixiang, 2008), and then integrate the data generated by above these two methods to get three-dimensional precise positioning. In the case where GPS satellite signals and CDMA network signal cannot locate separately, GPSONE system combined the two sources of information, as long as a satellite and a cell site is available to complete position, which solves the traditional problems. In addition, GPSONE system infrastructure auxiliary equipment also provides 20dB higher than conventional GPS positioning sensitivity, the use of hybrid positioning GPSONE can now work deep inside buildings. In addition, the use of GPSONE technology, the positioning very quickly, positioning time is short, and the power consumption of phone is not increased much.

4.2 Information Delivery System

This refers to information delivery platform between the mobile customers and operators, operators and content providers. The relatively mature delivery platform is SMS, of course, such as CDMA2000 1X, GPRS, 3G, WAP, CSD and so on.

In addition, WIFI has become a standard in many smart phone, and along with the construction of the wireless city, there will be more and more WIFI hotspots in the city. It seems that WIFI will become a underlying technology which information transmission system commonly uses. Compared with SMS and 3G, CDMA2000 1X, GPRS, the advantage of WIFI is obvious. First, the transmission speed, WIFI rate has reached the theoretical maximum value of 11Mbps, of course, because the actual impact of environmental factors, the actual rate is usual small than the theoretical value, but also quite substantial. Second, the fees is low. SMS 3G and so on the, its data is delivered on the telecommunications network, while WIFI is just a technology to access the the Internet. Compared with the telecommunications network, WIFI cost much little.

4.3 GIS System

Geographic information system is a system of computer hardware and software, which is to collect, edit, analyze, process and output, the position information. In the LBS, GIS's main role is: 1 Path navigation, guidance for users of the navigation routes. 2 Information inquiry, with the use of mobile information, to provide users with location-related space, and weather, traffic and other value-added services. 3 Remote tracking, monitoring, real-time operating the vehicle. 4 Track playback, displayed the vehicle running track according to records in the electronic map (Wang et al., 2009).

Simply put, GIS system turns the position information of mobile terminal into a visual position on the map. Under normal circumstances, we can only get three-dimensional geographic data from the positioning system, only through GIS processed, such data can be used for business service providers. Getting the location information of customers, it is equivalent to target specific customers, with only the means to target specific customers it is able to provide these particular customers with the corresponding LBS services. GIS systems can be provided by the operators, and also by business service providers.

4.4 Service Delivery System

It is a source of service to provide business to mobile customers. According to different market segments, business service providers could provide different types of customers with different services, such as fashion youth with location-based games,

chat, dating service, residential customers, business people with mobile nanny, traffic navigation, commercial advertising services, the industry provide with the vehicle scheduling, emergency rescue, logistics and distribution services.

4.5 LBS Manage System

Generally it is the operators responsible for the operation and maintenance. The LBS management System is the core of the location service system, and links mobile terminals and services providing system to enable mobile customers to obtain service he needs from a business service provider, location-based services such as a customer need to check where the famous flower shop or restaurant is in the vicinity. Or a business service provider push the customer information according to the location information of mobile clients, such as advertising through location-based services system. Meanwhile, LBS management system is also responsible for privacy management, user authentication management, business management and accounting management.

In the LBS framework, there is a important role, which is data mining. With the system used by user, the platform could accumulate much user behavior information. Data mining could help improve user experience using the information.

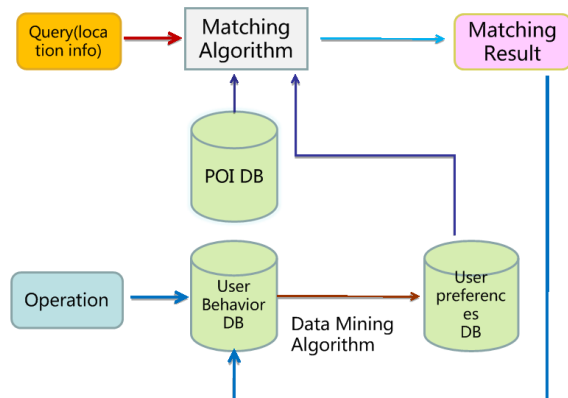


Figure 2: The sketch map of matching progress.

The figure above shows the sketch map of the matching progress. When user uses this platform to find, comment or check in somewhere, the operation is recorded by the server. Through the data mining, the system could find the user's preferences and record them in the database. So next the user comes to the application, the system could push the appropriate item which he is interested in.

5 THE TYPICAL SERVICE OF LBS ON THE NEW FRAMEWORK

5.1 Personal Surrounding Map Information

In most cases, users often do not know where they are, especially in the strange, there is no clear reference in the environment. In this case, it is difficult to describe the specific location on the map to their friends. With the personal map, your position information could be converted to images sent via MMS to friends. If two people are equipped with the same mobile LBS software, they can send the GPS location which is in the form of send text messages to each other, the receiver could open the messages using the same mapping software, and then can know exactly the specific location of each other (Yongxiang, 2009)

5.2 Individuals POI Search

Taking the size of mobile screen into account, points of interest (POI) on the electronic map on the mobile phone is often hierarchical display, which makes the user find the banks, hotels, shops and bus stops and other information from nearest location is too much trouble. Through the individual POI search, the users could selects from the current location to find POI information. Individual POI search supply a form of extended search mode, which is from one point to the surrounding to quickly grasp the useful information around (Chunhui et al., 2009)

5.3 Personal Location Information Inquiries or Share

Because mobile phones with GPS could get of the exact location of the user information, and the private information leakage due to query of private location information has been criticized much for mobile phones with the function of locating. Different from cell phone locate, GPS mobile phone can be set that the GPS position is open or not in order to protect personal privacy or the query or share personal location information function which is useful for special groups, such as the elderly, children and other special needs which it is necessary to know the location of the other.

5.4 Road Guide

Road guide features fully use the GPS navigation.

Input or select a specific position of the starting point A and end B then you can be informed of the path from A to B in the form of text or images. The text describes the path through which the road name, such as: [Egret Park] to [the lake park] path: Lake Road - North Hubin Road - Lake Road - Xianyue Mountain Tunnel - Nanshan Road - Huatai Road. Navigation picture is the images of things on the road. Path generation algorithm includes the shortest path, the main road first, straight preferred and other options. Meanwhile, it integrates the road guide track record and playback function. It is able to record the track of travel or the process of finding the path way real-time, which makes you able to know the return route in a strange environment, so that owners can enjoy themselves.

5.5 Thematic Information

The thematic information services need personalized data and the support of info server. Personalized data, is also known as rich points of interest (Rich POI). A restaurant Rich POI points, for example, compared to the usual sense of the POI data points, in addition to containing the name of the POI, longitude, latitude information, included address description, area code, phone number, profile, pictures, and even recommended signature dishes, cuisine, taste, dining environment and the dining experience of users and so on. Information server is provided by the service provider, could be accessed through wireless network for a specific POI. Current trends in integration of mobile phones and the Internet has become more evident, content and services will become more dominant area. Full use the function of network data communications of mobile phone, coordinate the software on the mobile terminal and information server, and provide users with information service platform. Mobile end-users using the same platform could easily mark geographical information point, introduce tourist attractions, make up stories related to geographical position and describe the traffic situation and so on. The info server collect information of all kinds, then edit sort, select, identify, storage, in the end make up some rich points of interest, and then open the processed the information to other users.

Through the establishment of server of rich points of interest, the thematic information services could provide the user with:

Introduction of Tourist Attractions

Many owners of private vehicles or hobbies GPS players enjoy MICE tourism. A lot of them hope to plan the travel route by car, and be able to learn more about Attractions and other information before to go. In order to meet the needs of this part of the user, it is necessary to rich the information of tourist attractions :: For normal POI search, users can get just the necessary information ,for rich POI search, the user could get much more information.

Classified Living Information Services

The key of whether the navigation and LBS services is popular is that whether the service provided close to life of the user. Category searching lives try to provide the user with lifestyle information as much as possible. The user can search by category to find the business, goods, rent and other various categories of information. This function can be got by category search, in this way it is able to concentrate on providing similar information to the user, allowing users to have more choice.

Business, Corporate, Product Introduction Services

In the POI search, each POI is probably a specific business or enterprise. Through the POI search, users can learn the business or enterprise product introduction and promotion. At the same time, the information server also supports member companies users to add POI information or custom POI's information, allowing various businesses and enterprises to enrich the POI information system, which is good for business enterprises and end users.

Weather Forecast Service

Information Server could collect weather information for many cities, and then provide it to the end users. In addition, some other information related to weather can also be provided to the user.

6 CONCLUSIONS

LBS define the framework of spatial information services and mobile location services, in the 21st century it will play an extremely important role. This paper presents a new framework of LBS, analysis some of the typical business which LBS could provide, then sums up the characteristics of LBS business:

The development of LBS technology is not mature at present, such as the industrial chain, is not immature.

The result of locating is in low accuracy. It is certain that these problems can be solved in the future a big development will be made in LBS.

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