

Constructing Campus Mobile SNS Based on FOAF

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Abstract—Mobile social network service has gained worldwide popularity among users nowadays. This paper proposes a campus-oriented and opened mobile social networking system for university students and faculties, to build a reliable trust relationship network on campus. It utilizes the campus wireless network and mobile devices to provide dynamic location-based social network services for users anytime and anywhere. This paper designs a system architecture based on Widget/Server mode. The system combines traditional social networking functions with context-aware technology, and precisely recommends friends based on Friend of a Friend ontology description. The future applications of campus mobile social networking system are also discussed.

Keywords—mobile campus community; mobile social networks; Friend of a Friend

I. INTRODUCTION

Social Network service (SNS), also known as virtual community, is based on Web2.0, including blogs, podcasts, professional vertical communities and so on. The SNS moves people's social networks to the cyber world [1, 2]. In recent years, SNS is one of the most popular Internet applications, it is based on the theory of Six Degrees of Separation and 150 Law [3]. The social nature of SNS greatly promoted the construction of interpersonal relation network. At present, well-known SNS websites are Facebook, Myspace, LinkedIn, etc. In China, there are Renren, Kaixin, etc.

Nowadays, Internet application modes are developing towards Mobile Internet, similarly, SNS is also developing towards Mobile Internet mode. Mobile Social Network Service (Mobile SNS or MSNS) is emerging. Paper [4] defines MSNS as an open community to connect people by mobile devices, which is a further extension of SNS

with mobility and rich context. MSNS has four basic features: 1) Activity-based; 2) Mobility and context-based; 3) Rely on mobile devices; 4) Open platform. At present, MSNS can be divided into three types: evolvement from mobile portal websites, migration from web-base communities and the original MSNSs [2].

As university enrollment expansion, the campus is becoming more and more crowded. However, surrounded by unfamiliar faces, the social network does not expand. Faced with this situation, MSNS gives us very good inspiration. MSNS community aggregates a large number of users and provides dynamic location-based social network service, users share information and organize activities to expand relation network [3]. There is no doubt that university students and faculties will benefit from campus MSNS community.

Compared with those MSNS applications provided to all users in society, such as Dodgeball, Loopt and Brightkite [5], the campus MSNS is campus-oriented. University students and faculties have similar education background and taste, and can form a more reliable trust relationship network. Besides, the system provides campus lecture and performance forecast information, so students and faculties can organize academic and cultural activities accordingly. Beijing Normal University developed an accurate locating mobile campus [6], which provided WLAN-based campus locating service, smart classroom and intelligent library. However, the campus MSNS system puts more emphasis on SNS functions of the community, such as friend recommendation and organizing activities.

The current friend recommendation mechanisms in SNS websites are mostly based on matching users' personal profiles, and recommend those who are matched

successfully. However, this mechanism needs users to input mass data, and the matching process is too simple to provide correct recommendation results. Campus MSNS system combines traditional SNS functions with context-aware technology, and recommend friends based on FOAF (Friend of a Friend) ontology description to increase the recommendation accuracy.

II. CAMPUS MSNS SYSTEM DESIGN

This paper aims to design and implement a campus MSNS system based on FOAF. It uses the campus wireless network and mobile devices to provide Dynamic Location-Based Social Network Services (DLBSNS) for university students and faculties anytime and anywhere.

A. Campus MSNS system architecture based on Widget/Server

Campus MSNS system adopts Widget/Server (W/S) architecture and follows REST style. W/S basically follows all the design rules of MSNS systems and could invoke local capabilities of mobile device. Mobile widget is a more suitable platform for MSNS application compared with the conventional B/S and C/S architectures. REST is based on standard HTTP protocol with uniform interface, so it is more suitable for the server side of MSNS system, and the system should also be opened with RESTful APIs [4].

The architecture design for campus MSNS system is shown in Fig. 1.

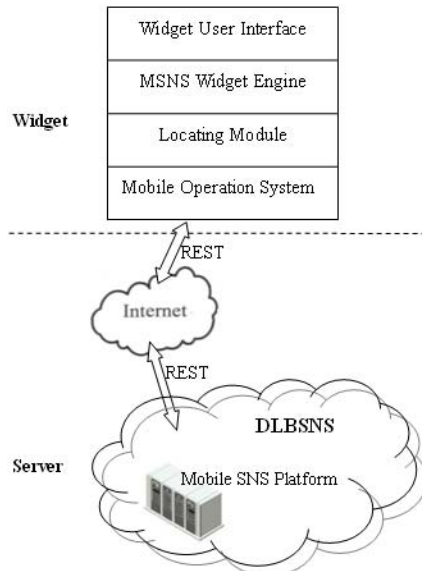


Figure 1. Campus MSNS system architecture

On the Widget side, terminal devices can be smart phone, PDA and pocket PC. Optional localization schemes for Locating Module include WiFi, GSM, GPS or their combinations. The localization scheme needs to make a tradeoff between localization accuracy and battery lifetime. Research shows that combining WiFi with GPS measurements improves accuracy and energy drain over either WiFi alone or GPS alone [1]. So a GPS module combined with WiFi is used for user locating on the Widget side.

MSNS Widget Engine is a mobile widget engine extended with some SNS applications, which is a middleware above the Mobile Operation System. As the core module of terminal side, MSNS Widget Engine provides APIs to gather user information and context information from local mobile devices, and provides some basic socializing functions for mobile widget applications [4]. Widget User Interface is used to interact with the users and present user profile, friend list and location information.

The Widget and Server side will interact in a common RESTful pattern. On the Server side, Mobile SNS Platform is designed to provide dynamic location-based social network service. The architecture for Mobile SNS Platform is illustrated in next part.

B. Mobile SNS Platform architecture

Mobile SNS Platform architecture is designed as Fig. 2.

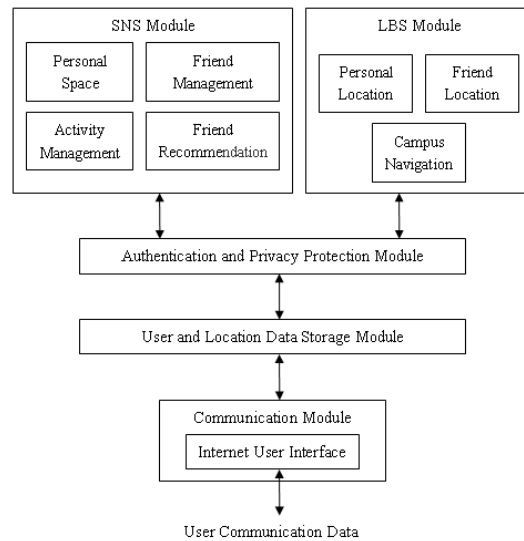


Figure 2. Mobile SNS Platform architecture

Internet User Interface in Communication Module is used to interact with mobile communication terminals, send and receive user communication data. User profile, friend list and location information is stored in User and Location Data Storage Module. Privacy protection not only is a security problem for a community but influence the feeling of the users, so an Authentication and Privacy Protection Module is designed. This module verifies user login information, as well as reading and writing operations on user information, which will be executed only when they accord with the users' privacy configurations.

SNS Module is the core of Mobile SNS Platform. This module provides typical social network services, which includes Personal Space Information Management, Friend Management, Activity Management and Friend Recommendation sub-modules.

- In Personal Space, users can create and edit a personal profile, publish logs, upload photos, set privacy configurations, and visit friends' space to share information.
- Friend Management sub-module provides a friend list to display friends' name, avatar, online status and current location (if he chooses to public personal location). To keep in touch with friends, PDA and pocket PC users can send internal letters or use Web instant messaging provided by SNS Module, smart phone users can send short messages or make phone calls directly.
- Activity Management sub-module integrates the latest campus lecture and performance forecast information, it provides a platform for the students and faculties to develop their academic interest and art taste. They can organize activities and send invitations to friends.
- The system will recommend to a user some "potential friends" who share the same interests with him. The recommendation mechanism is illustrated in section C.

Nowadays, academia and industry pay more and more attention to the research on location-based services and systems. Location-Based Service (LBS) means that, as the mobile device moves, the information services related to user's current location are provided correspondingly [6].

LBS is an indispensable part of Mobile SNS, and LBS Module is another core of Mobile SNS Platform.

LBS Module introduces a campus digital map, and provides location-based services. Google Maps API is used [7]. This module includes Personal Location Management, Friend Location Management and Campus Navigation sub-modules.

- In Personal Location Management, services are provided in terms of the context of a user's current location. The user's current location and surrounding landmarks are marked on the campus digital map. The user can also find out which of his friends have been to these places, together with their comments on them [8].
- In Friend Location Management, a user's online friends' current locations are marked on the campus digital map, with a location profile (if his friend configures personal location as public or only friends visible). In this way, a user can easily find out nearby friends, or search friends in a specified area.
- In Campus Navigation, a user can find the best route to a specified location on campus.

To follow REST style, all the capabilities of these modules in Mobile SNS Platform will be packaged as RESTful web APIs for 3rd parties to invoke.

C. FOAF-based friend recommendation technology

The FOAF project is one of the first attempts at a formal, machine executable representation of social networking. It defines an RDF (Resource Description Framework) vocabulary for expressing metadata about people (name, address, email), and their interests, relationships and activities. The open, semantic, and decentralized feature of FOAF is very suitable to define dynamic social networks [9]. FOAF has the potential to promote SNS, because this type of description can be processed by software. For example, it can be used by a search engine, and be used to automatically discover social networks [8].

In campus MSNS system, FOAF is used in user registration and login services, which verify a user's access right to Mobile SNS Platform. FOAF document submitted by a user is used to confirm whether the user has registered for Mobile SNS Platform. If he has

registered he can login; otherwise, he has to register by a FOAF document [10].

Campus MSNS system also provides friend recommendation service based on FOAF ontology description, to expand user's relation network. FOAF uses standardized XML/RDF vocabulary to express users' basic information, and to define relationships among people. And then a social graph where nodes and edges denote people and relationships is formed, as shown in Fig. 3.

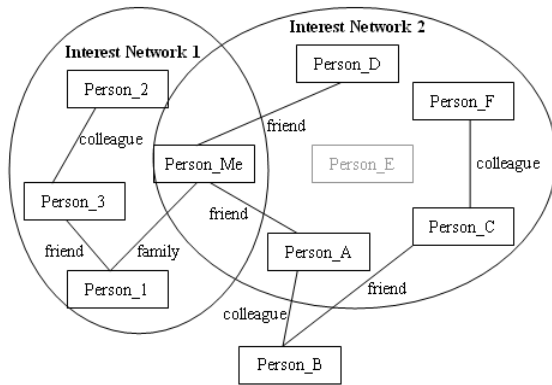


Figure 3. User relationship graph

Fig. 3 shows social relations of a user (Person_Me), and the relations are categorized into friend, colleague, family, etc. Mobile SNS Platform processes FOAF documents created on Web server to get users' information, and more significantly, to get which people are related directly to a user, or share the same interests. So we can recommend to a user those who have more common points with him. In Fig. 3, we describe two Interest Networks which are based on interest profiles of each user's FOAF document, people in one Interest Network share the same interest. Although Person_B is related directly to Person_A and Person_C in Interest Network 2, he doesn't have the same interest with them. While the gray node Person_E in Interest Network 2 doesn't know the other 5 people in it, so Person_Me, Person_A, Person_C, Person_D, Person_F are recommended to Person_E as potential friends. Person_Me is contained in both Interest Network 1 and 2, which means he has defined several interests, one of them matches Interest Network 1, and another matches Interest Network 2.

Besides the recommendation based on common interest, optional friend recommendation strategies are: having a specified number of common contacts, graduating from the same department, participating in the same activity, etc. Because FOAF gives a good description of each user's basic information, interests and relationships, Mobile SNS Platform can retrieve users' FOAF documents and easily implement these recommendation strategies, and then transports the results to the Widget side. Experiments show that FOAF ontology description has effectively increased the friend recommendation accuracy, compared with current friend recommendation mechanisms in SNS websites.

III. CONCLUSIONS

This paper designs and implements a web-based, flexible and opened campus MSNS system based on FOAF. It uses the campus wireless network and mobile devices to provide dynamic location-based social network services for university students and faculties anytime and anywhere. The system adopts Widget/Server model and follows REST style, which is an ideal architecture for MSNS system. Additionally, the system combines traditional SNS functions with context-aware technology, and recommends friends based on FOAF ontology description to increase the recommendation accuracy. A system prototype has been used in the new-generation China Academic Digital Library Information System (CADLIS) [13], which is a national project funded by the Chinese government and federates digital libraries for higher education and academic libraries. Overall, the user experiences of campus MSNS system are positive.

The theme of campus Mobile SNS based on FOAF can evolve numerous interesting applications. Paper [11] introduces a future nuggets mode for Mobile Internet: LBS + SNS + Group purchase. Inspired by this mode, the system can extend some campus commercial information services. Wherever a user is, he can quickly acquire his current location and nearby commercial promotion information, this is an enjoyable and affordable experience. Paper [12] raises a new variation of LBS: Bump combined with Facebook is exploring location recommendation field. The campus MSNS can extend a location recommendation service, which recommends to a user some restaurants, stores, and places of entertainment in terms of his interests.

As one of the most successful technologies for building recommender systems, Collaborative Filtering will be utilized to implement this service.

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