Investigation and Implementation of the Advanced Wireless Medical Registration Solution in China

Yue Ouyang, Shanghong Li, Xiupeng Chen, and Guixia Kang

Wireless Technology Innovation Institute
Beijing University of Posts and Telecommunications, P.R. China
oyy13429@gmail.com, gxkang@bupt.edu.cn

Abstract. Compared with the huge number of Chinese population, the medical treatment resource is very scarce. A universal and serious phenomenon emerges, that is, the registration becomes more and more difficult especially in some famous hospitals. There is always a long queue for registration and time is wasted. Is there not a technique to make the registration process more efficient? In this paper, we provide a new application, a WAP-based wireless registration solution, which aims to solve the medical registration problem in China. It will bring advantages in both healthcare service domain and WAP industry link[1].

Keywords: wireless medical registration, WAP, WML, PUSH.

1 Introduction

The matter of medical registration is universal in many countries. In China, compared with the huge number of population and the scarce medical treatment resource the problem is more serious. Investigation results show that, Chinese population takes 22% of the world's population, while the medical-sanitation resource takes only 2% of the world's total resource [1]. The relative scarce resource makes the problem of medical registration more distinct than other countries.

Besides, compared with secondary level hospital, famous higher level hospital is trusted by more people, which makes the "medical registration" problem more and more serious in these hospitals. The difficulty of medical registration leads to some abnormal phenomenon:

- people living far away from hospital have to get up as early as 4:00 a.m. in order to obtain a registration number;
- the number for specialist doctor can hardly be obtained even by queuing for a long time;
- there are "registration ticket packmen", who always stand in the front of the queue and register lots number of famous doctors, then sell the numbers at a very high price.

[1] The project is supported by Beijing Nature Science Foundation (No. 4062023) and 111 Project (No. B07005) of Ministry of Education (MOE) of China.

M.J. Dainoff (Ed.): Ergonomics and Health Aspects, HCII 2007, LNCS 4566, pp. 267–273, 2007.

Due to above reasons, the medical registration problem has been a serious social issue in China, especially in some big cities.

In recent years, national policies have initiated to support the advanced Information and Communication Technology (ICT) solution to solve the social issues. The guideline of National Metaphase and Long-term Developing Plan in science and technology [2] clearly declares that Modern Service Industry is an important development domain. As one of the serious social problem, the medical registration problem has been considered on the aspect. Researchers are encouraged to use advanced technology to manage the scarce medical resource and enhance the efficiency of medical registration.

With the development and generalization of mobile communication technology, more and more people possess handsets. The number of worldwide handset users was 2.14 billion in 2005 and will increase to 3.2 billion in 2010 [3]. The possess ratio of handset is much higher than the ratio of computers'. Because of the universality, mobile phone will become a main communication instrumentality between patients and hospitals. According to the 11-th Five Year Plan of National Key Technology Supporting Project in China, "Registration" through mobile phones is proposed as a possible solution in a sub-project of Area Cooperative Medical Service Demonstration Project [4]. The solutions might include the registration by SMS or WAP to alleviate the problem of registration and illogical allocation of medical treatment resource.

2 Registration Technology Comparison

There are several traditional methods for registration in China as follows:

1. face-to-face registration;
2. telephone registration;
3. Internet registration.

Method 1) is the most original method but also the most inconvenient one. People need to queue for a long time to get a registration number. Methods 2) and 3) are brought forward to make people convenient and alleviate registration pressure. However, both schemes are not as successful as expected, and the following problems still exist:

- the *registration ticket packmen* is rampancy due to the lack of correct manage mechanism;
- people need to queue a long time to see a doctor after they got a registration number, which will waste a lot of time;
- people need to wait to obtain testing results.

The WAP-based advanced wireless medical registration solution can solve these problems. It utilizes real-name management mechanism to deter *registration ticket packmen*; it depends on handset's universality to make ubiquitous registration come true; it introduce PUSH technology to inform patients to see a doctor at the right time intelligently after they achieve registration number and message patients to take testing results. Therefore, the solution enhances the efficiency of registration process.

3 System Implementation

The WAP-based wireless medical registration solution provides the following functions:

- wireless medical registration: use mobile phone to register hospital number through WAP;
- push-based queuing informing: use SMS or WAP-PUSH to inform patients to see a doctor or get testing results through PUSH;
- EHR (electrical health record) browsing: browse user's EHR by mobile phone;
- intelligent remote monitoring: system checks the parameters submitted by users intelligently and point out whether the health status is normal.

3.1 System Specification

The WAP based registration system consists of WAP clients, WAP gateways, and content servers. The handheld WAP client is usually a mobile terminal; it communicates with the content server, which stores information and responds to the user's request. The gateway translates and passes information between the client device and server [5]. Fig.1 shows the system infrastructure.

The system utilizes WAP technology to realize the connection between the wireless domain and the WWW domain. The related application data were stored or generated by the content server. The user-interface is written in WML (Wireless Makeup Language) and dynamic web programming script language, executed at the WAP device after it is downloaded from the server. This infrastructure ensures that mobile terminal users can access a wide variety of Internet content and applications. Also application programmers are able to build content services and applications that run on a large base of mobile terminals [6].

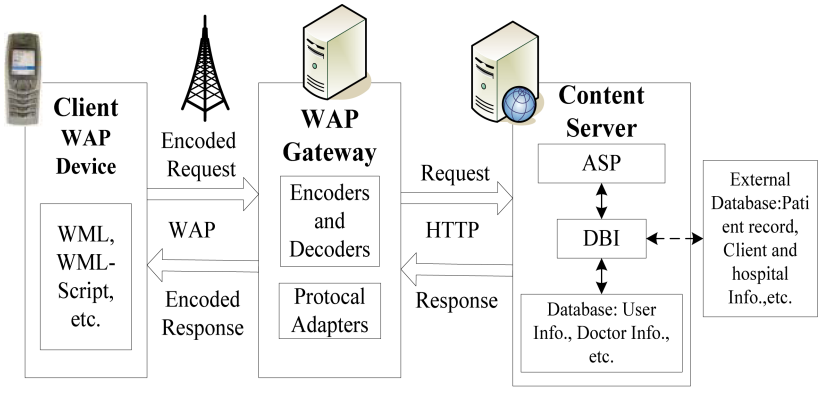

Fig. 1. Infrastructure of WAP-based wireless medical registration system

3.2 WAP Programming

WML is designed for creating WAP applications, and is user-interface independent. It supports text, images, user input, variables, navigation mechanisms, multiple languages, as well as state and management server requests. WML has been designed to adapt to the high-latency and narrow-band of the wireless network, and is mainly intended for displaying text-based contents. When a user accesses a WAP site, it sends back contents in the deck of cards which the user can browse through. Wireless bitmap (WBMP) format is a graphics format optimized for efficient transmission over low-bandwidth networks and minimal processing time in WAP devices. It uses no compression in order to suit the limited processing power of the WAP client device.

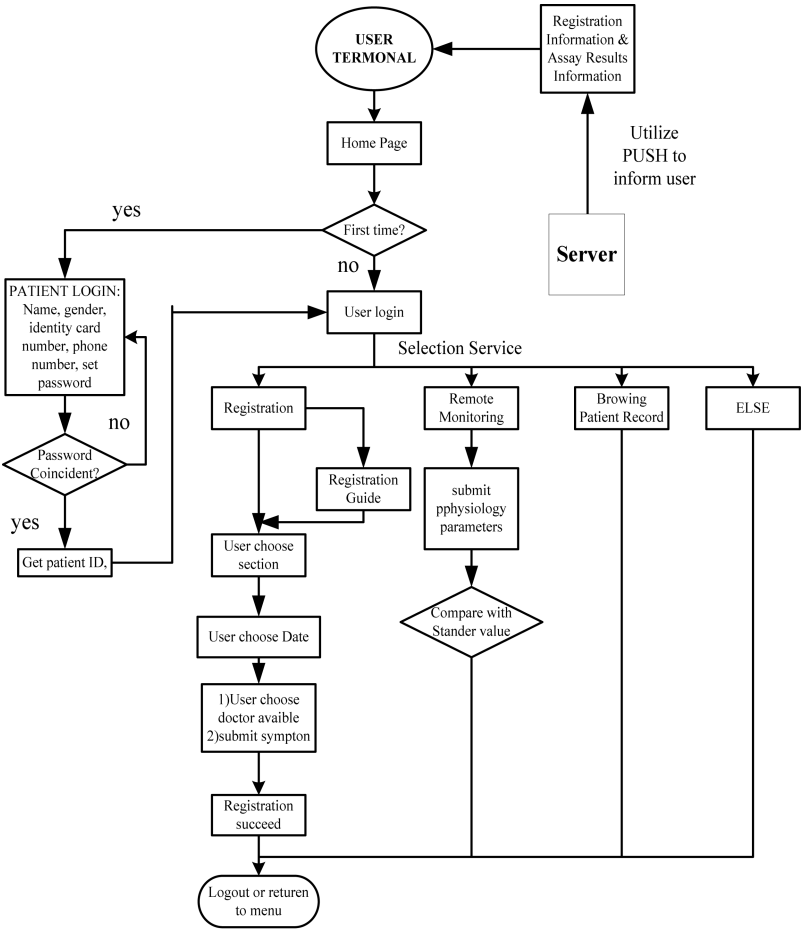

Fig. 2. Flow chart for WAP-based Registration menu

The flow chart of the program shown in Fig.2 starts when the user accesses the first WML deck at a predefined site. The following WML decks that the user interacts with are then generated by dynamic script language.

As shown in Fig.2, when patients use the system at the first time, they need to enroll first (Fig.3-a, Fig.3-b). The enroll information includes patient's name, gender, identity card number, handset number and password. After successful enrollment, the patient can get a patient ID number. The ID number and identity card number consist of the exclusive identifier of the patient, which can be used to manage registration information. Then the patient logs in the system to select different services, such as registration, remote monitoring, browsing EHR, etc.

If the patient chooses the registration service, they need to select a department first (shown in Fig.3-c and Fig.3-d), then select the date and the available doctor, or input their symptom, and finally the system will feed back a registration result containing department, cost, registration number and the order (Fig.3-e). According to the user's order and intraday diagnosing speed, the system can intelligently inform patients to come to hospital at the right time by using PUSH technology.

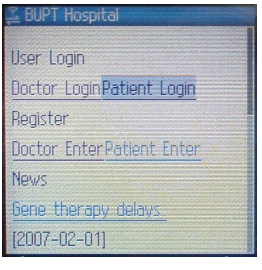

Fig. 3a. Page of Patient enroll and login

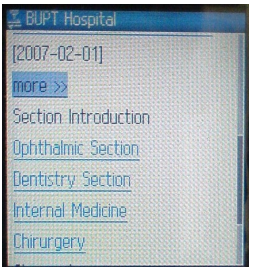

Fig. 3b. Page of Registration Guide

Based on the platform of the registration system, some extended functions can be developed. As an example, the remote intelligent diagnose is shown in Fig.3-f. The enrolled consumer can input the physiology parameters and the system will judge whether these parameters are normal by comparing them with the standard value and the patient's history health record.

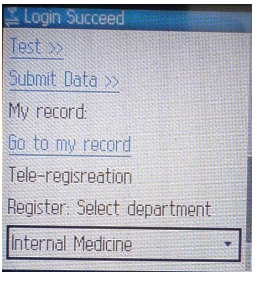

Fig. 3c. Page of Registration

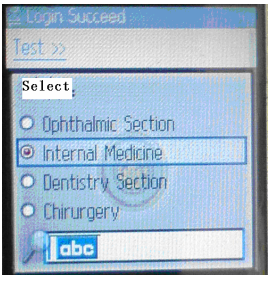

Fig. 3d. Page of Selection Department

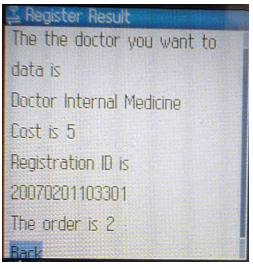

Fig. 3e. Page of Registration Result

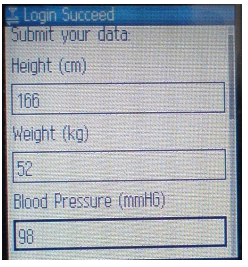

Fig. 3f. Page of Remote Intelligent Diagnose

4 Discussion and Conclusion

4.1 Discussion

The demonstration system of the WAP-based wireless medical registration works well in hospital test environment. However, some problems still emerge during the testing.

The first problem that needs to be pay attention to is the access speed of the WAP client device. The average access speed of handset to open a WAP web page is about 2~ 4 seconds and even more than 5 seconds for some handsets at the first time of accessing, which is much slower than that of computer's. The slow connecting and processing speed will prohibit the widely acceptance of users to wireless registration method if the users can not obtain the final registration information after 3-5 pages.

The next problem is how many users can access to the servers simultaneously. Although WAP-based registration system can be employed anytime anywhere, the users' simultaneous accessing number should not be ignored, because more and more WAP based services will be supplied in future. Some of the services may take a little longer time to operate and transmit, for example, the WAP-based amusement by handset. Therefore, the priority of services based on WAP should be well organized by the mobile operators.

5 Conclusion

The WAP-based advanced wireless medical registration system exceeds the traditional registration services in both technology and management aspects. The system has the following advantages:

- because of the portability of mobile phone and the wide coverage of mobile networks, it is convenient for people to register anytime anywhere with a WAP-based wireless registration;
- WAP-based registration can alleviate the problem of registration by patient pre-identification; T*icket packmen* can be avoided by real-name management mechanism;
- medical registration information saves the unnecessary long waiting time.

However, deploying such advanced wireless medical registration scheme in China is not a simply technological issue. It still requires the following conditions to cooperate and even in some extend these conditions take the main position:

1. Government recognition
   -- to operate the new registration method successfully should be supported by hospital itself first. However, to get the service, people have to pay the GPRS cost or pay some cost about handset mobile web service. The payment increases the cost of registration. So, how to balance the WAP-based additional handset cost and the real medical cost should be negotiated by the government institution and telecommunication operators.
2. Public support
   -- although the WAP-based registration system can bring convenience to most people, this system has some restrictions to people's handsets. It requires the handset to support WAP function and some handset must go to open the related function in sales department. In addition, the public need to learn how to use handset to browse website first, then they can understand how to use the WAP-based registration service. So technology training must be considered for promoting this kind of service.

In a word, to let the WAP-based registration prevalent is not only the technology problem but also a social problem. A successful story should only be made based on the collaboration among technology provider, service operator, policy maker, and so on.

References

1. The idea of establishing the new five-years plan in China will occur revolutionary change.http://news.xinhuanet.com/politics/2005-10/30/content_3702362_1.htm
2. http://www.most.gov.cn
3. The research of the market of globe mobile WAP service (2003) http://txzxs.cnii.com.cn/0527/ca364762.htm
4. The application tutorial of the 11-th Five Year Plan of National Key Technology Supporting Project in China – the 14-th subproject: Area Cooperative Medical Service Demonstration Project
5. van Leeuwen, J. (ed.): Computer Science Today. Recent Trends and Developments. In: LNCS. vol. 1000, Springer-Verlag, Berlin Heidelberg New York (1995)
6. WAP-210-WAPArch-, 20010712, Version 12-July- 2001 (2001) http://www.openmobilealliance.org/tech/affiliates/wap/wapindex.html