User Experience in Public Information Service Design for Smart Life

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Abstract. In the context of accelerated development of information technology and knowledge--based economy, smart life comes near to us. In this paper, we would talk about the design of intelligent public information service. We take the project "Beijing Electronic Health Records" as cases to analyze the problems encountered in our life, and we will analyze digitized resources and the application in the city and clarify public information needs from the user's perspective. On this basis, this paper will also include an in-depth study of urban public information service design principles and methods, and conduct cross-disciplinary research in information science, social sciences and design. Finally, we conclude three main perspectives to design and evaluate the smart public information service system: interfaces of technology-mediated mobile terminals, process of information based on advanced technology such as Mobile Cloud Computing, and a feedback mechanism to strengthen human interaction accessibility in public information service system. Not only do the three points maintain system performance, but also they play a significant part in enhancing User Experience (UX) in public information service system.

Keywords: Public Information Service, Interaction Design, User Experience.

1 Introduction

Interaction Design (IxD) is "about shaping digital things for people's use", alternately defined as "the practice of designing interactive digital products, environments, systems, and services." IxD concerns the intersection of people and technology. With the development of technology, more and more intelligent products have been around us, a convenient, smart life comes true. At the same time, a series of problems brought about by the rapid development of the city disturbed people's life, people were swamped by information flood, Designers need to think more about how to use information technology to make people's lives better place from a full-scale perspective. In fact, a word "smart city" has already been a hot topic on many fields. The concept of "smart city" is defined as "can take full advantage of all the

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interconnected information available today, in order to better understand and control urban operations, and optimize the use of the limited resources of the city." Moreover, smart city is heavily focused on satisfying the needs and desires of the people, bringing them pleasure to live in such environment.

Along with the development of information technology and the information network, many products have been extra multi-functionalities and full of various kinds of contents. With the "intelligence", products become complexity, and the users often have to work hard to blend them into daily life. Obviously, the user experience hasn't been thought carefully, or it hasn't been enhanced or has a corresponding improvement in this information explosion environment. The fact shows sufficiently that public information service design should consider more from the perspective of users to improve the quality of information service.

In this paper, we will discuss what kind of features should be considered highly for public information system, and our practice on developing for both the mobile terminals and data processing terminals, we also analyze the current state of smart city research and study users needs on public information service, then giving crucial design principles and direction of future development. Finally, based on experiences and cases study, we distill a set of design recommendations and describe how they will bring an intelligent life to ordinary people.

2 Related Research

There is no doubt that the smart city should have efficient and convenient public information service system.

2.1 The Connotation of UX in Public Information Service System for Smart Life

User Engagement

Public information service system is an interface between smart services and ordinary users. It should provide user-targeted service, which could be easily understood by users. In the context, we should have an accurate understanding of users' real demand. Nowadays, The Internet provides a convenient access to information, and support the interaction between users, system, contents and other users. Moreover, more useful information in Internet motivates users' participation and impel them interact with the information service system.

Dynamic Experience

"User" in "user experience" is an abstract concept of groups, and it varies in specific environment with different users, for instance, the skilled users and non-skills have very different needs on the functions of the software. Even to the same user, different environment fuels different aspire. Public service should not only think highly of users'

instantaneous experience but also pay more attention to a long, lasting development experience. Only in this way, could the information service system build a lasting learning relationship with users, use the Internet to lead user demand and improve the service system.

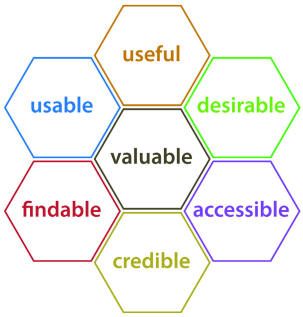

Fig. 1. Peter Morville Model

Technology Integration

Advanced information technology is the foundation of smart life. Information technology has penetrated to the information service system in every side. Many people thought that the intelligent quality depends on the extent of the intelligent. However, it is really not that the success of product is the technology. From the point of the users, how to choose and use technology needs more thoughtfully consideration.

2.2 Public Information Service System Model Viewed from the Design and Engineering

Design Procedure

The UX target is to experience public interactive information service from user view while not to evaluate the effectiveness of this system for the design procedure. Peter Morville brought up a beehive model UX target model (picture 1).

On the basis of Peter Morville, James Melzer made complement of his model on two aspects (picture 2). First amendment is to change the position of the accessible and credible information, which leads to the second amendment --- change the outsides into two groups: utility and affordance.

Utility answers whether the information satisfy users' demands and expectations; affordance tells us whether users could be able to seek out and use public information service, or the communication between users and system. If applied to the public information service system design, user requirements such as information access, quality and value could be reflected from the two sides.

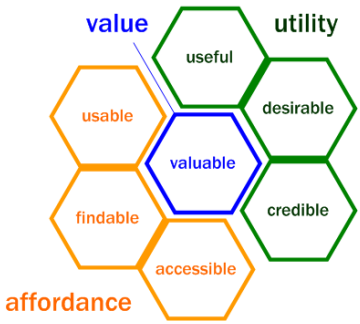

Fig. 2. James Melzer Beehive Model

Engineering Procedure

The public information service system for smart life is actually a system in which users could fulfill his/her demands and complete communication with machines or other users. Core elements included in public information service for smart life are personal interfaces, processing background, and a feedback mechanism connected background and personal interfaces together. In this paper we introduce the process of interaction about input interfaces, background data process method and connection mechanism for engineering procedure.

Intelligent Interface (Interactive Device)

Interactive device is the media to finish the interaction between user and public information service. Traditional interactive devices, such as mouse, keyboard, have poor operability and understandability during the interaction with public information service system. Novel interfaces that consider more about human factors, like tangible desktop, virtual keyboard, and electronic devices become popular and they can also control and communicate with background terminal.

Processing Background (Web Information)

The combination of UX and web information, on one hand, optimize UX from aspects like content organization, structure design, support for complicated interaction, which lead to an excellent performance to achieve user target, psychological satisfaction and emotional dependence; on the other hand, through the network information or web-based applications, data and some user information could be uploaded to the background to start a cloud computing and then got feedbacks from the web server. In this method, the dynamic interaction happens as a positive communication between users and the public information service system. Background design based on network and web information considers an overall UX, takes interactive process, function design and users' feelings as a whole in order to improve the system usability, intelligibility, and aesthetic value.

Feedback Mechanism (Communication Platform)

Interactive feedback mechanism to the user interface model provides a variety of feedback data with the web information through interactive process. Feedback mechanism is a communication platform for users, mainly including correlation data feedback and user feedback information. The indirect correlation data feedback is an interactive process of recessive user behavior tracking from the public information service system. It discovers and captures the users' actual intention and behavior patterns. Meanwhile, the direct user feedback data is an independent feedback entrance to the system for users to submit various problems and relevant evaluation, which could be viewed as separate interactive channel for both the designers and users and also a direct access towards the users' thoughts. The interactive feedback module supplies many kinds of relevant feedback data and user information to the background.

3 Case Studies

Here we would like to present the case of Electronic Health Records in Beijing to discuss more deeply. These information service systems involve different levels of user activity: intelligent interfaces, computing terminals and evaluation feedback mechanism.

Electronic Health (E-health) Records in Beijing

E-health is defined as the cost-effective and secure use of information and communications technologies in support of health and the related fields, including health-care related services, surveillance, literature, education, knowledge, and research, both at the local site and at a distance. And e-health is definitely a necessary part in public information service system. It will make personalized medicine possible and affordable in the near future. The adoption of e-Health technologies in medical fields creates huge opportunities yet lots of challenges still need to be resolved to build reliable, secure, and efficient networks or platforms with great flexibility.

In this case, we would analyze the e-health records (EHR) built up recent years in Beijing. EHR is directly emerged from health related activities and saved for future reference value. It takes health as a center point and chooses life as a main line, which achieves an accumulation record for the user from his/her birth to death. Recorded the development of change of health and death, health information service becomes a continuous, comprehensive, individualized health record information database. At present, the whole country is promoting the community medical service model of this EHR transformation and user-oriented residents EHR becomes the key point.

Here in the case, this public information service background is web-based and strongly organized. It allows the public e-health system to provide data for medical treatment, prevention, health care, rehabilitation, health education and family technical health guidance. The establishment and application of EHR information service system turns into the most concerned research topics and it proves to be a significant symbol of

regional health information. The network and data processing procedure accomplish a large health file, a useful tool for the community doctors to provide a complete data of residents' health and help doctors to master residents' health status. Furthermore, this background database and information network makes the community medical treatment, prevention and health care develop towards a scientific management orbit of systematization and institutionalization so as to monitor disease, dynamic changes. Still, it permits the transfer among different systems so that the EHR could be updated continuously and used secondly to future medical quality control, epidemic situation analysis and database for infectious diseases.

Moreover, the feedback mechanism is set up for users to be aware of their health status. Users could check out the electronic records periodically in order to be aware of their health status. In this feedback mechanism, correlation data feedback gives an overall comprehension of their current health situation and relevant health recommendations. And user feedback information provides information to doctors and information service organization for them to maintain residents' digital records of their diagnosis and treatment activities.

However, a convenient and dynamic user interfaces are needed like the wearable devices in order to manage users a dynamic communication with information service system. With the dynamic interfaces, the community health service agencies are able to keep tracking a continuous data or physiological indexes. And these files will become foundation for the establishment for children EPI (Expanded Program on Immunization) file, maternal health records, and students' health files. The interfaces should be designed to make users' life more convenient and promote users' communication with information service system regardless of interface forms. For instance, the Georgia Institute of Technology developed a home medical nursing robot which could fetch items like medicine bottle, open and close doors, chat with users and then deal with their problems by becoming users' life and emotional assistant. If robots could send users' information and data back to the service system, the information service would be more flexible to provide desirable information services. However, in public information service system, this field is still in a stage developing and designing a single sensor, such as the non-contact infrared thermometer, pulse sensor and blood pressure measuring instrument. And in the respects of network interfaces, portability and wearable resistance much left to be improved. Along with the development of information service and interaction technology in medical care and EHR, we believe that the e-health records and information service will develop rapidly.

Using ubiquitous computing technology, e-health information service can get the physiological information parameter thus detecting the abnormal diagnosis and enhancing the reliability of the information service system. Consequently, EHR is considered to reduce the avoidable hospitalization in nursing homes and community hospital for a short-term or long-term treatment. From the structure and construction of EHR information service system, it could be concluded that the doctor-centered information system is transforming into a user-centered information system which could be applied to scenes outside hospitals.

Further researches and efforts should be paid into body sensor networks and wearable sensor systems, clinical bio-feedback, decision support systems, e-health information and network infrastructure, and e-health for public health (including

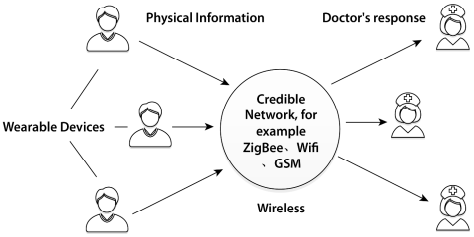

Fig. 3. An information Service Model with Feedback Module

disease prevention, emergency preparedness, epidemiologic interventions) when designing improvement information service system. E-Health for ageing (to support quality of life for older adults, aging in place and independence) is also emerging novel e-health applications with functions of health monitoring and the technology of health grid and health cloud.

When establishing public information service system, as concluded from cases, are harmony interfaces settings, strong communication through web information platform and a feedback mechanism that can make continuously self-improvement and self-maintenance.

4 The Interaction Design

As above, there are three main dimensions in the interaction design of public information service: technology for individuals' information engagement, accessible interfaces of technology-mediated mobile terminals, and a feedback mechanism to adapt to human accessibility.

4.1 Harmony Interfaces of Technology-Mediated Mobile Terminals

Nowadays, more Internet services are becoming ubiquitous. With the growing capabilities of the network and the rising penetration of broadband services into our life, users are experiencing a new model of human-computer interaction in which information processing has been thoroughly integrated into everyday objects and activities. Some cutting edge HCI interfaces are increasing, such as Remote Phone, Virtual Keyboard, Smart Desktop and so forth. During the development of user experiences, the accessibility and usability of the interfaces become essential.

Nowadays, wearable computing is thought to be a good choice. Google Glass or TTP Glass sees the world through users' eyes and makes them aware of location, Internet fresh news, or even presenting images when calling. Strata Watch can be linked to cell-phone and other terminals to upload applications and monitor devices, replacing the traditional mobile phone and producing a fantasy user experience. Heads-up displays, such as Vuzix Displays could be set up around the city corner so that you touch news on the screen commodiously.

The pervasive model in which we have many processing units for users is well suited for smart city design. Wearable Computing interfaces could be a personal device that opens the gates for ubiquitous computing to the smart city entertainment.

4.2 Process of Information Based on Mobile Cloud Computing

In recent years the mass adoptions of mobile devices and increasingly ubiquitous connectivity have contributed to a radical change in the way people interact with computer systems. Moreover cloud computing infrastructures have paved the way for the development of smart systems such like smart city, whose goal is to provide a service to enhance user experience based on environment and user sensed data. There is a clear disconnection between the two streams that flow continuously between user and cloud-based systems. On the one hand, user- and environment generated data is being, for the most part, disregarded by service providers. On the other hand, services offered do not address users' specific needs and preferences. In addition, service discovery is a cognitive demanding process and it may have detrimental consequences in user experience. Hence, we propose user-centric frameworks. The framework facilitates the design and development of smart city systems. It aims at leveraging existing technology, such as environment sensors and personal devices, to aggregate localized user-related data - defined as a bubble - into the cloud.

This aggregation later supports the delivery of personalized services, contextually relevant to users. Above all, we could handle data sent back from individual more accuracy, and then present a pinpoint service for users. Meanwhile, smart city construction direction can be determined by specified information visualization. The delivery of services with such characteristics has the potential to enhance quality of experience and influence user behavior.

4.3 An Efficient Feedback Mechanism to Strengthen Human Accessibility

Traditional HCI interfaces scarcely have a feedback mechanism. However, by utilizing the cloud computing technique to collect, analyze and transfer information, controller terminal can be more intelligent that they could be self-control and self-adjusting to a more accurate level. That is to say, intelligent and adaptive interfaces and data processing allow service to follow up easily changed human needs.

5 Limitations and Expectations for UX Desing Model

5.1 UX Design Model

Emphasizing on UX connotation and strengthening interaction have important significance in designing a public information service system for users to leading a smart life. The information service should supply a targeted and personalized service in order to obtain a pleasant UX.

5.2 Limitations

Technology has been providing a good service for human beings. And the best interfaces in public information service system should be disappeared when not in use and appears again naturally for users when needed in the process towards an intelligent and comfort life. However, technique cannot go that far at present considered the

limitations of software, hardware or network. And the storage and analysis of dynamic large scale information in daily life also put barriers to public information service development.

5.3 Expectations

Human-computer symbiosis is the highest level of human computer interaction in the public information service design. A design of the close integration between human brains and computer information will make it possible for computers to figure out huMAN THOUGHTS AND DEAL WITH DATA from a novel perspective. Thus, this means helps people realize what their real demands are and fulfill those needs. However, public relationship and society moral problems should also be taken into deep considerations when achieving such expectations.

6 Conclusion

Technology is developed to serve human being. Smart City creates a better environment for citizens to enjoy their life. These smart computing technologies or cutting edge interface devices should be emerged when in need and disappeared if not necessary. In other words, they need to be invisible into daily life. The way we spend our lives and deal with information will be distinguished a lot. Harmony interfaces, computing technology in the information network processing procedure and a feedback mechanism established the public information service design basis for smart life. Based on the three factors as mentioned in this paper, the traditional single design thinking would be changed and a whole system thinking would be the main considerations for user experience.

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