Wireless Paging System Model on Ubiquitous Computing Environment

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Abstract - *Ubiquitous computing environment means the computing environment that has taken its position so closely with the ordinary living so much like air or water. In building up the U-Korea, one of the important issues is the social issue from the drastic increase of senior population. The contemporary society has its distinct trend in increase of senior household following the nuclear family orientation, increase of working parents with the advancement of women in society, unable to support seniors for long distance or short distance of business trip and other reasons that the need of senior welfare has been ever more felt. Accordingly, the Ministry of Government Affairs and Home Administration has developed the wireless paging system to make prompt response system for 119 Rescue when the single senior is encountered with emergency situation that is has been widely provided for the socially neglected people such as single senior, the disabled persons and others. Currently, the wireless paging system is operated as the sub-system for emergency rescue information system, but due to the lack of reliability of product, problems of terminal portable transmitter, receptor and others, rejection of beneficiary and lack of knowledge in use, insufficient management and supervision of managing officers, the efficiency has been declined that there is a need of development for the system.*
Therefore, this study proposes the context aware information structure of the subject of ubiquitous wireless paging system required for the development of the wireless paging system model of ubiquitous environment that improved the problems of currently operated wireless paging system.

Keywords: Wireless paging system, Ubiquitous computing.

1   Introduction

One of the important issues in U-Korea construction is the social problem from the drastic increase of high age population. The contemporary society has the situations where the single household in seniors is unable to be taken care of from the nucleus family, increase of working couples with the advancement of women into work force, long distance or short distance trips of dependent family and others that the needs of senior welfare is all the more acute today.

Accordingly, the Ministry of Government Affairs and Home Administration(MOGAHA) has developed the wireless paging system that a single senior would have single operation of a device in times of emergency for 119, the 119 emergency crew is dispatched for prompt response that it had the pilot operation in the Seoul and Busan areas in 1997, dispersed nationwide in 1998, and developed into the nationally subsidized project from 2000 to have the system applied to entire single seniors, disabled persons and other neglected class of people[4].

However, the wireless paging system has declined in efficiency from lack of reliability on the product, problem in terminal, portable terminal and reception terminal, rejection of beneficiaries, unfamiliar way of use, worsening finance of suppliers for frequent recalls and A/S, excessive work load of manager, and lack of care in management that there is a need for better system[2],[4].

Therefore, In this study, 4W1H+L+PI is proposed as the context-aware information structure of subject for ubiquitous wireless paging system needed for developing the wireless paging system under the ubiquitous environment that is improved with the currently operating wireless paging system in this thesis.

The purpose of this thesis is to enable the proposed 4W1H+L+PI structure to structure the wireless paging system of the ubiquitous environment to contribute to the high level of the fire and disaster prevention information system following the 8 new services and 3 infrastructure of IT 839 strategy of the government.

The composition of this thesis is that the Chapter 2 considers the Smart Home related study and application case that is based on the precondition of structuring the wireless paging system, and the Chapter 3 contemplates the context-aware computing and the wireless paging system as the theoretical background, and the Chapter 4

proposes the ways of informatization for context that is subject for ubiquitous wireless paging system and develops the responsive scenario of the ubiquitous wireless paging system. And, lastly, Chapter 5 is the conclusion of this study.

2 Related Work

For the Smart Home related study that is the preconditioned upon the structure of wireless paging system, AwareHome[12],[13] realized by Georgia Tech for high age senior living, EasyLiving[14],[15] of MS for realizing the intelligent environment, Adaptive House[11] of Colorado University with the target on home automation, the house_n Project of MIT to design and realize for Smart Home itself, and, UbiHome that combines Ubiquitous Computing and Smart Home of U-VR Lab. of the Gwangju Institute of Science and Technology [6],[7],[9],[16].

2.1 AwareHome of Georgia Tech

AwareHome means the residential environment that has the capability of recognizing the information of home and around home, and information on activities of resident. AwareHome uses the concept of Human-Like Perception to develop various services for high aged persons[12],[13].

2.2 EasyLiving of MicroSoft

MS Research Center has realized the test product called EasyLiving that has the ubiquitous computing technology and structure. The demo on this pilot product can be seen on the MS's web-site(S.A.N. Shafer) for various ubiquitous computing. EasyLiving system has the final objective in structuring the intelligence-type environment. The goal of the intelligent-type environment is to provide the desired computing resources that the user wants on the mobile terminal, and in addition, when the user does not have the portable terminal, the user environment is considered to approach to the computer resource[14],[15].

2.3 Adaptive House of Colorado Univ.

The concept of Adaptive House is, unlike the present home automation to control the residential environment by displaying the status of the residential environment or recognizing the touch screen or voice command to control the residential environment, the living pattern of the resident or the requirement of the resident are observed for the data through the sensor installed for the residential environment, and program the change of environment suitable to the data outcome observed by the residential environment itself and apply the nerve-network theory to perform the learning capability on the change to the residential environment that the house would be able to forecast what the residents requires [11].

2.4 House_n Project of MIT

House_n Project includes the desired home system of the resident when building a house to built the individualized house for resident. In other words, when building a home, wall or construction materials include the home network or various sensors within [18].

2.5 Gwangju Institute of Science and Technology UbiHome

Gwangju Institute of Science and Technology U-VR Lab. defines the UbiHome as the residential environment that combines the ubiquitous computing and Smart Home. UbiHome means that a variety of sensor is combined to have the context on the resident and residential environment that, by combining such contexts to find out the intent of the residence, this residential environment provides the convenient service thereto [7],[9],[16].

3 Theoretical Background

3.1 Context-Aware Computing

Context-Aware Computing was first discussed by Schilit and Theimer in 1994. Here, the context-aware computing is adopted to the group of 'use place, surrounding persons and properties, and as time lapses, it is defined as the software to accommodate such changes'. Thereafter, there has been several attempts to define the context-aware computing, and in most cases, it is overly specific.

The definition of recently improved context-aware computing can be made as the context aware system in the event that the context is used during the course of providing appropriate information or service related to the works of user is provided. The types of such a situation may be diverse, but the general situational information can be classified as follows.
- User situation(normal, illness, accident damage, interference)
- Physical environment situation(indoor, automobile, outdoor)
- Computer system situation(power On/Off, internet On/Off-line, log In/Out)
- History of mutual reaction for user-computer
- Operation situation of IPv6 of building structure and internal structure

3.2 wireless paging system

When a single senior in need of living protection or heavily disabled person is supplied(installed) with the 119 auto beeper, and when encountered with emergency or in need, press the emergency button of the portable remote-con or fixed device(terminal), it automatically goes through Korea Telecom(telephone network) to report to the fire station(Comprehensive Situation Room). From the fixed device installed in the beneficiary family, the voice is automatically received repeatedly at the situation room of the fire station, and the 119 situation room computer

not only shows the personal information, contact, history of illness and others of the reporting person but also to hear the communication or record the voice between the reporting person and the situation room of the fire station to have the 119 emergency rescue in times of urgency, and the composition is shown as Figure 1.
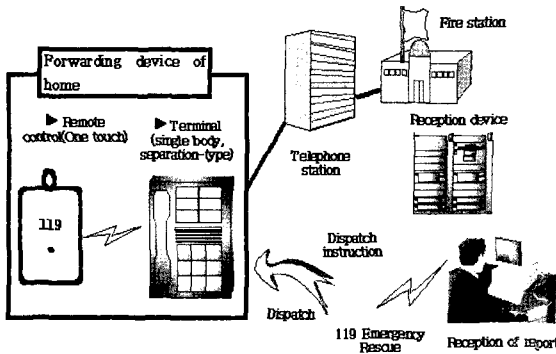

Figure 1. Configuration chart of wireless paging system

4 Model for wireless paging system for ubiquitous computing

4.1 Subject for ubiquitous wireless paging system

The subject for ubiquitous wireless paging system is the subject with the system as the term ubiquitous implies. Speaking of it in easier term, it means the subject matter that can be connected anywhere and anytime. In order to make the connection beyond time and place by the user, the subject other than physical elements from the traditional subject have to be included for informatization.

4.2 Context information of subject matter of the ubiquitous wireless paging system

4.2.1 Theoretical definition of Context 5W1H

The reason with low frequency of use on the single context is that there is no consistent approach to the context for adjustment and management. Because of such a reason, according to the advance study that handled the context information in the computer field, the information of 5W1H[1],[3],[5],[17] is proposed to use to express the context information. 5W1H(Who, What, Where, When, How, Why) means Who(resident aware), What(subject aware), Where(structure and subject location), time for the incident to occur(When), how the incident arises(How)' and Why(posture and attempt of resident), and by using 4W1H(Who, Where, What, When, How), it recognizes 'why the incident arises(Why)'. In such an information on 'Why', it provides the reason to change the residential environment that it is the most final context.

4.2.2 Definition of 4W1H+L+PI

With the structure of earlier mentioned 5W1H, the same context of object, resident or housing material and object within the subject of the ubiquitous wireless paging system can be understood differently among them. Depending on the position of people using the space, the reaction of the ubiquitous wireless paging system shows differently that the location information of people has to be included in the elements of context structure. In addition, the current condition information is referred to as PI.

Therefore, in this study, 4W1H+L+PI is proposed as an expression of the context information.
For example, the information that resident H1 is lying on the bed at 7:10 can be expressed with the bed being ·What', H1 as Who, 7:10 as when, position of H1 as location, namely, the bed is the location, and the condition information of H1 as applicable to PI.

4.3 Processing of context information subject for ubiquitous wireless paging system

4.3.1 Concept

The context based application uses the ubiquitous computing based structure to generate the information on user and surroundings of user, namely, context, and based on the context, it provides the information or service needed for the user [8],[10]. Therefore, the context based application structure under the environment, the part to provide information on the context(sensor) and the part to provide service by using context(application) are existed as the individual elements. However, the sensor and application have the dispersed individual features for mutual reaction when needed for context. For this purpose, the sensor and application do not use the intermediary medium that generates and manages the context but to require the mechanism that directly reacts. In the meantime, the study on context-based application has already been undertaken in various fields, including automation, HCI and others. For example, ACHE(Adaptive Control of Home Environment) of Colorado Univ. uses the nerve network to find out the repeated behavior pattern of the user to build up the residential environment including indoor temperature, illumination, temperature of the shower water and others [11]. Furthermore, MIM (Multimedia Interface Manager) of Rutgers University uses the multimodal of user(visual, sense and hearing) as the context to provide the communication context-aware computing of user and computer.

4.3.2 Information structure for context reacting housing

Figure 2 displays the reacting process of housing following the context [1].
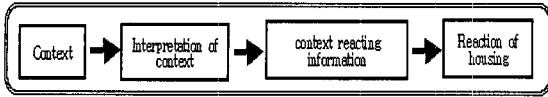
Figure 2. Responsive process of housing following context

Once the context information is determined, housing reacts by the context. For example, the color of the wall may change or door is open by the context. Also, the window may be closed and the cooling and heating equipment may be operated. In order to operate the construction material or sensor to compose the housing, the information have to be delivered. For ubiquitous housing, the digital technology has to be the basis that there is a need for efficient information delivery method through the formative system of information. For efficient information delivery, the information has to be formulated like in the context information. Another word, there is a need for information system to control and modify all situation arising within housing with the reaction to the context.

4.3.3 responsive process of context based housing

The context surrounding the housing is not in static condition but to continuously changing information. The housing of ubiquitous has to be able to assert its function to elastically respond to the context information as well.
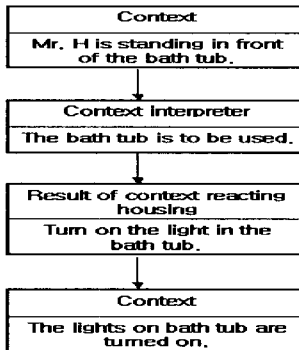

Figure 3. Reaction Process

As such, the housing responded to the context can easily realize the concept of the ubiquitous housing. Because of such reasons, there is a need of developing the process of housing reacted to the context. Figure 3 shows the cases of changes in housing as the basis of context of residential environment as presented in Figure 2.

4.4 Reaction scenario of ubiquitous wireless paging system

Mr. H getting up at 6 o'clock in the morning opens up the bathroom door and the sensor turns on the light. Once the user is identified, the blood pressure, blood sugar,

and body temperature are checked. Currently, the blood pressure and blood sugar of Mr. H are in dangerous condition that the health of Mr. H is recorded in the resident health DB and the wireless paging system of the applicable situation room of the fire station would have the current information of Mr. H displayed now. The responsive scenario is shown on Figure 4.

Context 1	
Mr. H comes to the rest room.	
Context Interpretation	
Attempt to walk in to the rest room.	
What	rest room door
When	06:00
Who	Mr. H
How	Approach to the rest room door
Where	Location of the rest room door
Location	In front of rest room
PI	information filmed on camera
Outcome of subject for Context reaction	
Open the rest room door.	
What	rest room door
When	06:01
How	Door is opened by the sensor.
Where	Location of the rest room door
Location	Location of the rest room door
PI	information filmed on camera
Context 2	
The door for rest room is opened.	

Context 2	
The door for rest room is opened.	
Context interpreter	
Mr. H is in the rest room	
What	rest room door
When	06:02
Who	Mr. H
How	Sensing if the subject person is within the subject
Where	Location of the rest room door
Location	Inside the rest room
PI	information filmed on camera
Outcome of subject for Context reaction	
Checks the health of Mr. H	
What	Cup holder and toilet lever
When	06:03
How	Health diagnosis by the bio-sensor
Where	Sensor location
Location	Inside the rest room
PI	information checked by the sensor
Outcome of subject for Context reaction	
Close the rest room door.	
What	rest room door
When	06:04
Who	Mr. H
How	The door is closed by the sensor.
Where	Location of the rest room door
Location	Outside of rest room door
PI	information filmed on camera
Context 3	
Blood sugar and blood pressure are high.	

Context 3	
Blood sugar and blood pressure are high.	
Context interpreter	
Compared to the normal figure - Risk	
What	Resident health information DB
When	06:06
Who	Mr. H
How	Exchange information with DB
Where	Location of the rest room door
Location	Inside of rest room
PI	Sensor and DB information
Outcome of subject for Context reaction	
Information indicator on the situation room of the fire station	
What	Communication equipment
When	06:06
How	Risk condition of the subject (check result) is delivered to the terminal of the fire station
Where	Position of wireless paging system
Location	Position of Mr. H
PI	Health information of subject
Outcome of subject for Context reaction	
119 Emergency and contact nearby hospital	
What	wireless paging system
When	06:06
Who	Mr. H
How	Emergency communication network
Where	Situation room
Location	Situation room
PI	Dispatch and treatment request
Context 4	
Transportation and treatment of Mr. H	

Figure 4. Responsive scenario

The responsive context for the subject of ubiquitous wireless paging system on the scenario begins from the resident, H1, coming to the rest room, and the following is the description of the contents of 4W1H+L+PI structure as described.

First, the motion of Mr. H to approach to the door is sensed by the sensor on RFID, Ubi-floor and others, and by the RFID device of resident is inputted for Mr. H for the information applicable for who. The information applicable for location is responded for the location value of Mr. H in comparison with the position value of the reacting building material(What) with the position of Mr. H for each hour.

Another word, when the value of When is 6:00 am, the position of Mr. H has been inputted as in front of the rest room door that he is yet to be inside the rest room. With the result of the context reactive subject, it sends the signal to the switch sensor of the rest room door applicable for What on the above How information. The door opens with the operation of the switch of the door, the location information of Mr. H's location information is updated with the internal location value in the rest room. Through this process, the context change of the housing reaction is expressed in "the rest room door is open".

Second context is the situation where the "rest room door is opened". Again, the ubiquitous housing recognizes that Mr. H came into the restroom from the updated

location information, namely, the location value of resident applicable to Who and the location value of the construction material in Where for comparison and thermal sensor, and with such interpretation of context, the primary housing reaction causes the switch sensor to close the door of the rest room. Next, the ubiquitous housing is inputted by the resident in advance to respond to the next service, and in this scenario, it assumes to check for health of resident applicable for who by the living information or material within the rest room. Namely, the information applicable for How in the secondary housing response, it checks the health by the thermal sensor and skin resistance sensor and sense the high blood pressure condition(PI).

The third context is the situation of "high blood sugar and blood pressure of Mr. H", and the context interpretation delivers the information to the situation room of the fire station depending on the situation with comparing the appropriate blood pressure DB of the appropriate figures and health information of the resident Mr. H and request(PI) for dispatch of 119 emergency and treatment at a nearby hospital.

5 Conclusion

This study has the ubiquitous system for the subject of wireless paging system that the subject and residents can be connected at anytime and anywhere to control for the context of the subject of ubiquitous wireless paging system in formative way, and develop the scenario to present the cases of responsive process for the subject of ubiquitous wireless paging system following the scenario.

In this study, the method to formulate the context for subject of the ubiquitous wireless paging system is proposed and present the responsive process without realizing or evaluating the actual system. In the future, the space where we live in will be changed to the environment where the physical space and electronic space for organically linked and integrated. Therefore, there is a need of acquiring the prompt and real time information for ubiquitous wireless paging system to have and confirm the situational information at the site to control by concrete and in-depth research and system and heighten to protect the personal privacy and security.

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