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A DESIGN STUDY OF PEDESTRIAN SPACE AS AN INTERACTIVE SPACE

Park Ji Hye

College of Design, INJE University, Kimhae, Korea, dnjhks@hotmail.com

ABSTRACT:

In the past, space has functioned to determine and adjust physical reality of a dwelling place for people. However, nowadays, diversely changing human environments and technical paradigm have caused to create a new space concept that attempts to link space to digital, beyond digitalizing and giving the space its identity. A series of recent studies and experiments on the interactive space which can provide information for the users and can communicate with them have proven such a tendency. Recently, this change became a focus of attention in the area of space design. It would be re-interpreted as visual, auditory, or tactile multimedia space as well as sensible space with which human beings interact, being delivered from the constraints of limited boundaries of the existing space concept.

This study explores the applicability of interactive technology in the space design with a focus on the pedestrian space which must meet aesthetic and symbolic functions along with the function of providing information. The present study chose the pedestrian space in general hospitals where a

differentiation in the information is possible. General hospitals consist of complex and diversified smaller spaces within bigger intensive and compact spaces, requiring the function of various and quick delivery of information. In addition, provided information and functions vary with the space users such as patients, medical staff, and caretakers.

In this respect, this study investigates symbolic, aesthetic, cultural and information-providing functions of the pedestrian space as well as its fundamental functionality. This study also investigates characteristics and functions of the pedestrian space in general hospitals and analyzes pedestrian space design in light of its information-providing function.

A research on users' acceptability is administered on different groups of patients, medical staff, and caretakers in general hospitals. On the basis of analysis results, the study intends to propose a new strategy for the interactive space design, in order to meet the need of users. Although this design proposal is carried out at an experimental level, such a proposal and attempt tests the possibility of interaction between space and users, and is expected to expand the area of the digital design by suggesting a new multimedia space which is integrated with digital technology.

1. INTRODUCTION

1-1. STUDY OBJECTIVE AND BACKGROUND

As times have changed and technology has been developed, space, which has been used for a certain fragmentary purpose, is now playing various roles at the same time. Space is no longer a term representing a certain situation where people and things are surrounded by three dimensional limits – upward and downward, front and back, left and right. Rather, not only has it a variety of functions such as information delivery and aesthetic/symbolic functions, but also there have been attempts to adapt digital factors in it. Since space is performing many integrated functions simultaneously now, such words as 'multitask space' or 'interactive space' are more and more widely being recognized. However, such utilization of complex functions in a space is still very limited, and majority of space is used for a fragmentary purpose yet. Especially, the special space of a general hospital is usually used by random people and is supposed to provide a lot of information for many individuals at the same time in a limited space effectively, but many

domestic general hospitals have way-finding problems in terms of the use of the uniform design, same materials and colors. This makes visitors lost the way, which causes emotional problems such as anxiety and tension, physical problems such as rise of blood pressure, and increase of pulse frequency, and realistic problems such as waste of time resulting from being unable to be on time for the appointment.[1]

This study, therefore, aims to present the sign system as a special information guide function with interactive and emotional designs, focusing on the general hospitals where a lot of information is needed within a limited space. Examination of the meaning of pedestrian space design by means of literature study is followed by the investigation on the sign system, which is the essential factor in information delivery, especially on current conditions of sign systems in the special space of general hospitals and on multimedia sign systems. Based on this, the interactive sign system of general hospitals will be evaluated in terms of the adaptability, and then designs for a new sign system will be presented, which is the very ultimate objective of this study.

1-2. STUDY RANGE

The meaning of pedestrian space design will be examined based on existing case studies and literature study. In addition, the current conditions of the general hospital sign system and interactive sign system regarding pedestrian space for the human traffic special function[2] will be included in the examination. Based on this, users' behavior patterns will be analyzed focusing on the lobby and corridor on the 1st, 2nd, and 3rd floors, the mainly used space of the general hospital, which will be followed by the analysis of complaints on the current sign system. In this regard, users are divided into three categories: medical specialists, guardians, and patients, among which, users who want to take the hospitalization procedure or outpatient treatment application on their first visit, that is, the guardians or patients who are unfamiliar with the sign system of the general hospital. In the first experiment, the problems were revealed, and the prototype introducing the technology suitable for the new design suggestion was produced, and then the 2nd experiment was conducted among the test group in the identical environment. Based on the results of the 1st and 2nd experiments, the design plan of the new sign system effective to the interactive sign system in the general hospital was presented, and the future study issues were examined, too.

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[1] A Study on Differentiation of Pedestrian space, Kim Jin Woo and Rhee Jae Won (2004) Journal of Korean Society of Design Science, South Korea, November 5
[2] Information (table 1)

2. SIGNIFICANCE & CLASSIFICATION OF PEDESTRIAN SPACE DESIGN

Pedestrian space means the space created and planned for pedestrians to walk and move, and the scale and functions are suitable for human walking.[3] Pedestrian space is designed and planned to provide an area for human walk activity and separated from vehicles. Besides, in more general sense, this space may involve any movement other than walk, and include any outdoor life activity rooted in human nature.[4]

Location Characteristics	Spatial Continuity	Since this space is made for moving, it should be the nearest straight distance between two points without a break.
	Time Continuity	Walk should be continued without a break in terms of time, and the continuity is complementary with that of day time and night time.
Functional Characteristics	Human Traffic Space	Concentrating or separating the human traffic with the same strong goal
	Square Function	Formation of local communities, and use as a market or meeting place
	Scenery Improvement	Friendly life that space provides richness and comfort in terms of urban scenery
Symbolic Characteristics	Recognized as an object with a symbolic to the citizens	

Table1: Characteristics of Pedestrian Space[5]

As seen in (Table 1), the characteristics of pedestrian space can be divided into three aspects: location, function, and symbol. This indicates that pedestrian space is not mere a space for walk, but it has various characteristics for walking activity. Among the factors of pedestrian space with a variety of features, focusing on the location information guide sign system with the human traffic spatial function 'Concentrating or separating the human traffic with the same strong goal,' the general hospital guide sign system that can be specialized and differentiated was selected and analyzed.

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[3] A Study on Differentiation of Pedestrian space, Kim Jin Woo and Rhee Jae Won (2004) Journal of Korean Society of Design Science, South Korea, November 5
[4] Theoretical Characteristics of Pedestrian Space in a City, Hwang Jea Hoon (2003) Journal of Korean Society of Design Science, South Korea, November
[5] A Study on Differentiation of Pedestrian space, Kim Jin Woo and Rhee Jae Won (2004) Journal of Korean Society of Design Science, South Korea, November 5

3. ACTUAL CONDITION OF SIGN SYSTEM IN GENERAL HOSPITALS

3-1. ACTUAL CONDITION OF SIGN SYSTEM IN GENERAL HOSPITALS

3-1-1. Current Condition of the Guide Sign System

Figure 1: Existing general hospital guide sign system

As in (Figure 1), the existing general hospital sign system mainly consists of texts, colors, and pictures, and even though the major users of general hospitals are patients, the guide sign system providing patients with location information is unsatisfactory. When the guide sign system of general hospitals, which is supposed to provide a lot of information within a limited space, can not be satisfactorily effective, users are likely to feel inconvenience. In fact, there are many who could not promptly recognize the guide sign system of a general hospital and thus are confused or consult the guide desk. Furthermore, new plans for the sign system to provide users with accurate information are insufficient.

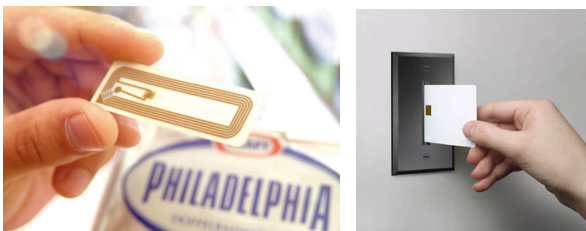### 3-1-2. Application Technology

Figure 2: RFID, smart card application technology examples

The major technologies of the general hospital guide sign system include RFID, smart card, and wireless communication,[6] among which, RFID(Radio frequency identification) is a no-contact recognition system that uses a small semi-conductor chip to process and send information of things and the surrounding environment. Modification and addition of tag data are free, and a large amount of tag data can be interpreted at once. Even under poor reading circumstances in terms of the temperature, humidity, dust, and heat, the interpretation rates are high.[7] Besides, the smart card means the plastic card in which the microprocessor and memory chip are embedded so as to process and save the information within the unit.[8] Among these, the RFID technology suitable for the new sign system design suggestion is chosen and the prototype is developed based on it.

3-2. ACTUAL CONDITION OF THE MULTI-MEDIA SIGN SYSTEM IN GENERAL HOSPITALS

Figure3: Example of the multimedia guide system

More and more hospitals tend to make gradual changes in the guide system for general hospitals which should provide lots of information within the limited space. By means of the ubiquitous hospital system (ubiquitous solution- by means of smart card, wireless communication, PDA, RFID, etc, Anytime Anywhere Computing environment is provided – is adopted in the hospital information system so as to maximize the convenience of the medical staff and patients), [9] the

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[6] Industry situation of Ubiquitous Hospital, Jo Jun Gyeong (2006) Institute for Information Technology Advancement, South Korea, < http://kidbs.itfind.or.kr/new-bin/WZIN/WebzineRead.cgi?recno=0901014266&mcode=jugidong >, January 25

[7] RFID Industry, Park Jung Hyeon (2005) "Mobile wide/ Mobile U" South Korea, August

[8] Smart Card Technology and Market Trend, Park Cheon Gyo and Lee Yun Cheol (2001) Electronics and Telecommunications Research Institute, "Trend Analysis of Electronics and Telecommunications", South Korea, October

[9] Industry situation of Ubiquitous Hospital, Jo Jun Gyeong (2006) Institute for Information Technology Advancement, South Korea, < http://kidbs.itfind.or.kr/new-bin/WZIN/WebzineRead.cgi?recno=0901014266&mcode=jugidong >, January 25

convenience of patients is promoted. The non-stop service by means of the smart card completes the treatment and reception process and omits the complicated administrative procedure, and now in places other than hospital, remote treatment service can be provided. Besides, the RFID terminals notifying the next treatment by voice also contributes to and accelerates the development of the existing general hospital guide system. However, many general hospitals still provide information relying on the existing guide sign system method, which makes patients' complaints remain. In addition, since the general hospital ubiquitous system is the priority compared to the sign system to find one's channel, the interactive sign system to reduce time to find the channel is essential.

4. EVALUATION OF THE ADAPTABILITY OF THE MULTI-MEDIA SIGN SYSTEM IN GENERAL HOSPITAL

4-1. OBJECTIVE AND METHOD OF THE EXPERIMENT

This experiment is conducted to present a new design adding interactive elements to the existing sign system among the pedestrian space factors of general hospitals. First of all, as for general hospitals, 39 domestic university hospitals are visited or analyzed, and the general characteristics are divided into the following three folds: human traffic, building structure, outpatient treatment.

Human traffic	Complicated connection of a series of corridors
Building structure	Usually, the main building and wings are separately planned.
Outpatient treatment	Outpatient treatment facility is located on the 1st~3rd floors for the users to move conveniently

Table 2: The structure of domestic university hospitals

As in (Table 2), the system of university hospitals was analyzed, and among them, the experiment was conducted for Paik Hospital which is the affiliated hospital of Inje Univ. to which the researcher belong, and the information is accessible.

To analyze the users' behavior in the general hospital, a certain task was set, a virtual scenario was designed according to the task features, the interactive sign system prototype was developed in reference to the 1st experiment for way-finding only with the existing sign system and RFID technology based on the experiment, and then the 2nd experiment was conducted. Among the subjects of the 1st and 2nd experiments, a post-experiment interview was conducted to draw up a

more accurate problems and solutions. By examining this experiment, whether the new interactive sign system or the existing sign system will be more effective is discussed.

4-2. TASK EXPERIMENT FOR THE ANALYSIS OF THE USER BEHAVIOR

Examining the problems of the sign system and coming up with a new improved method are the main points of the 1st and 2nd experiments respectively. Based on this investigation, the virtual scenario was developed for usability evaluation by means of the user observation and prototype.

As above, the virtual scenario for user behavior pattern analysis and the specific task were set accordingly to design the scenario.

Test group	Task	Needs	Function
20~30 years of age Those who visited the general hospital for the first time or have not been for 2 years, those who have never taken the hospitalization procedure	Treatment application writing desk	Guidance to the treatment application writing desk	The sign system that clearly indicates the location of the treatment application writing desk
	reception window	Needs for human traffic guide information to the reception window	The guide sign system that shows the human traffic to the reception window
	3rd floor the dentist	Needs for general guide information to 'the dentist'	The guide map that shows the general information on the destination
	3rd floor payment section	Needs for human traffic guide from 'the dentist' to the payment section	The simple guide system that indicates the order and procedure from the treatment to the payment section
	1st floor patient administration window	Needs for guide information to the 'patient administration window'	The guiding sign system giving the information on the direction and exact location on the way from the lobby to the patient administration window

Table 3: 1st, 2nd experiment scenario design

 (Table 3) above shows the virtual scenario to analyze the users' behavior patterns, five tasks, and the result of the needs and function analysis. Based on this Table, certain tasks were presented regarding 'treatment application writing desk-reception window-3rd floor the dentist-3rd floor payment section-1st floor patient administration,' and the users' behavior patterns were analyzed.

4-3. EVALUATION OF THE ADAPTABILITY THROUGH THE SCENARIO

The subject was those who visited the general hospital for the first time, have not been for two years, and have not taken the hospitalization procedure even once. Among the outpatient treatment sections in Paik Hospital, a dentist's office relatively hard to find was selected, and centering on the 'route from the dentist's office to treatment and to the hospitalization procedure,' a specific task was presented without any further information. In addition, only the sign system of the hospital was allowed to be used so that the behavior pattern according to the scenario can be analyzed in the 1st experiment.
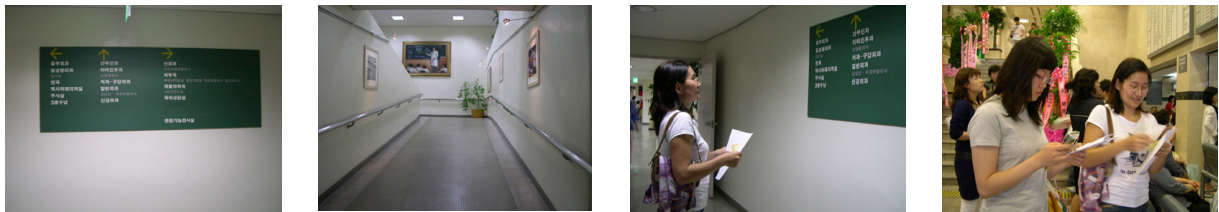

Figure 4: 1st experiment process

Test group	Treatment application writing desk	Reception window	Dentist guide sign system recognition	3rd floor the dentist	3rd floor payment window	1st floor patient administration
subject 1	00` 03`` 24	00` 09`` 53	02` 11`` 06	02` 17`` 14	02` 41`` 01	04` 12`` 07
Subject 2	00` 03`` 70	00` 12`` 15	02` 23`` 25	02` 42`` 63	03` 15`` 24	04` 49`` 32
subject 3	00` 33`` 20	00` 39`` 92	01` 03`` 24	02` 59`` 13	03` 41`` 87	05` 19`` 58
subject 4	00` 02`` 51	00` 20`` 05	03` 12`` 60	03` 23`` 91	03` 56`` 58	05` 58`` 46
subject 5	00` 49`` 25	01` 12`` 92	04` 14`` 29	04` 20`` 61	05` 09`` 17	07` 07`` 08

Table 3: 1st experiment time passage for each task

 (Table 3) shows the time taken at each task of the five steps among the test groups respectively. Especially, the time taken at 'recognition of the dentist guide sign system,' and 'the 1st floor patient administration' was the longest, and in the process, subjects felt confused. Besides, some even were not recognized the guide system and just passed, or some were lost without noticing his/her own location. After the 1st experiment, all subjects said 'difficult' to the question whether there was nay difficulty in proceeding according to the scenario. All subjects felt that each floor guide systems and human traffic guide systems were most difficult to recognize, and some said that

more sign systems or systems indicating the exact direction and location were needed. Even though information in such complicated limited space is essential, there were only few sign systems that provided proper information, and if any, the composition of the sign systems was hardly recognized or understood.

To analyze and solve these problems, a new prototype was developed to present, and then the 2nd experiment was planned with the same task and in the same environment with the 1st experiment.

Also in the 2nd experiment, the subject was those who visited the general hospital for the first time, have not been for two years, and have not taken the hospitalization procedure even once. They were given the same task, and included in the way-finding experiment by means of the developed prototype. Prior to the full-scale experiment, the problems of the 1st experiment were examined, the paper prototype was created, and the pilot test was conducted. As a result, the axonometric isometric-used guide sign system was more easily recognized than the text-type basic guide sign system. The former shows the route from the current location to the next destination, and it turned out that it is more effective for users to be able to refer to the specific information once again at the destination.

Based on this result, the full-scale 2nd experiment was conducted, and the prototype developed contains the isometric used in the pilot test and the system showing the route from the current location to the next destination. The same environment and task in the 1st experiment were used, and the test group as well was in the same conditions with the 2nd prototype experiment.
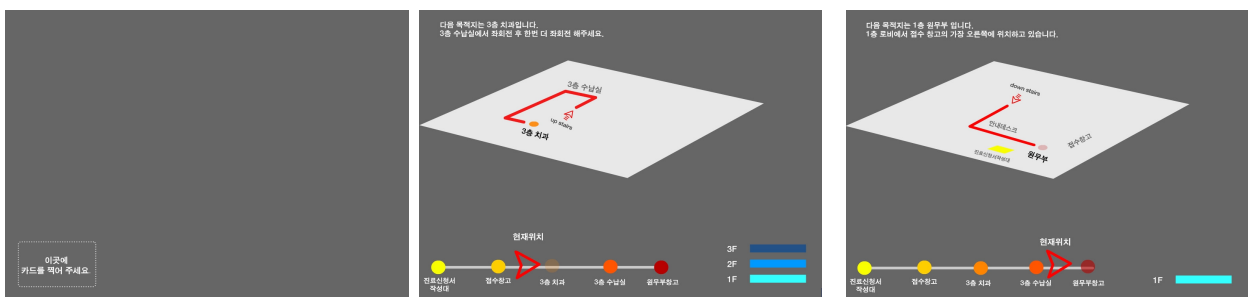

Figure 5: 2nd experiment prototype

(Figure 5) shows the prototype used in the 2nd experiment. Once the RFID card is recognized in the zone for the small chip, the floor and route are displayed, and even the route searching through isometric is possible so that the current location and the route to the next destination are shown. The experiment with the prototype resulted in the following results.

Figure 6: 1st experiment process

Test group	Treatment application writing desk	Reception window	Dentist guide sign system recognition	3rd floor the dentist	3rd floor payment window	1st floor patient administration
Subject 1	00` 01`` 96	00` 08`` 25	00` 50`` 86	02` 13`` 67	02` 57`` 47	04` 18`` 09
Subject 2	00` 01`` 77	00` 09`` 57	00` 29`` 26	01` 55`` 80	02` 38`` 55	03` 48`` 08
Subject 3	00` 09`` 27	00` 16`` 95	00` 38`` 90	02` 16`` 28	02` 58`` 64	04` 20`` 98
Subject 4	00` 03`` 59	00` 09`` 76	00` 31`` 78	02` 20`` 89	03` 07`` 50	04` 28`` 76
Subject 5	00` 15`` 35	00` 32`` 36	00` 32`` 36	02` 50`` 36	03` 45`` 12	04` 31`` 95

Table 5: Time passage of each task in the 2nd experiment

 (Table 5) shows the time taken in each task of the five steps among the test groups respectively. The parts that took more time than any other, and cause confusion - 'the dentist guide sign system recognition,' and '1st floor patient administration' – were outstandingly shortened with 2 minute difference. In other words, the new interactive sign system in the 2nd experiment using the prototype turned out to be more recognizable than the existing sign system. In the interview conducted after the experiment, all the subjects answered "Yes" to the question whether they could perform the tasks without any problem. To the question whether the interactive sign system is more recognizable than the existing sign system as well, all answered yes. As for the isometric used in the prototype, to the question whether the isometric or the text was more easily recognized, all said that the isometric was more recognizable. To the question whether the interactive guide sign system helped to recognize well the human traffic, 80% and 20% said "Yes" and "No" respectively. Lastly, to the question whether the interactive guide sign system is essential, 20% said 'absolutely yes," and 80% "yes." This indicates that they showed positive response to the interactive guide sign system used in the prototype.

4-4. RESULT ANALYSIS

Among the pedestrian space factors of general hospitals, the guide sign system is mainly considered, and problems that the existing sign system has are grasped based on the result of the experiment conducted with the existing sign system and the newly presented design prototype. As a result, the improved new design received positive evaluations. Through this, it turned out that the existing sign system of general hospitals should be changed with the interactive guide sign system that meets the demand of users, and that there are needs for a sign system through which users can be given needed information properly, and easily recognize the complicated procedure.

5. DESIGN SUGGESTIONS & CONCLUSION

5-1. DESIGN SUGGESTIONS

Based on the results of the 1st and 2nd experiments, the newly designed guide sign system is presented to help recognize the route easily.
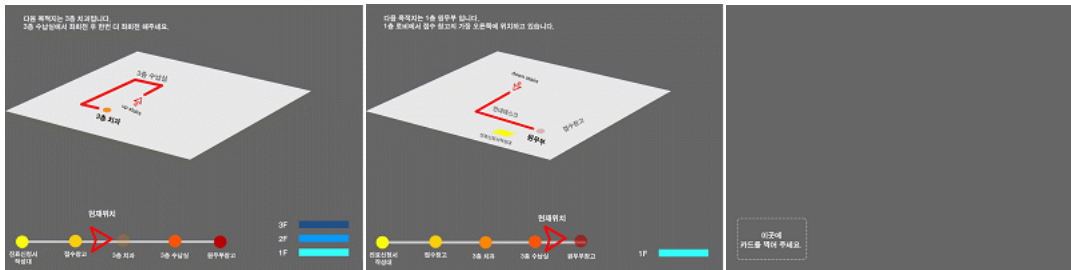

Figure7: General hospital interaction guide sign system design plan

- The interactive guide sign system that shows the user who visits the general hospital to recognize his/her own treatment route in a form of simulation. (figure 7)

-By means of isometric, the direction and route guide design is presented on the cubic structure. (figure 7)

- The level of the interactive guide sign system should be between 600(mm) and 1350(mm) so that it can be at the eye level of users on a wheelchair and pedestrians. (figure 8)

- Users receive the filing receipt and RFID card that contains the treatment route from the reception window, and have the interactive guide sign system located at the corridor recognize them, then the route is displayed on the sign system in a form of simulation.

- To give information on where to go next in detail, some texts are shown for additional explanation, and the user coming up is described simply.
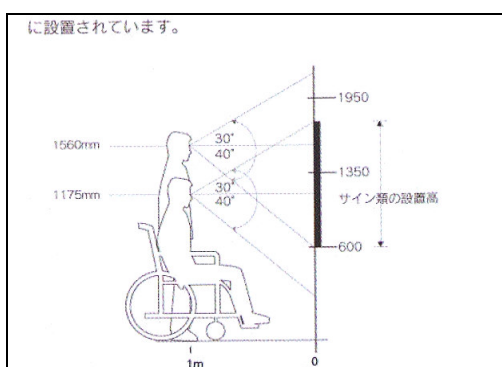

Figure8: The sign system location of installation [10]

5-2. CONCLUSION

The existing general hospital sign system mainly consists of texts, colors, and pictures.

The guide sign system for the special and limited space, general hospitals, has caused difficulty and confusion in users' recognizing needed information. Thus this study aims to present new interactive and emotional guide sign system for general hospitals. First of all, the problems of the general hospital guide sign system are analyzed, based on which, two experiments are conducted to present a new design. Centering on Paik Hospital among domestic university hospitals, the route from outpatient treatment to hospitalization as a task will be performed in the 1st experiment by means of the existing guide sign system without any additional information, while on consideration of the 1st experiment result and the problems raised during the pilot test, the improved prototype is developed in the 2nd experiment. As a result, the route finding by means of the existing guide sign system without any further information, in some cases, could not provide and useful information for a user to find the route, and even some users were lost the way. In the 2nd prototype experiment, which grasped such a variety of problems and improved functions, the newly presented interactive guide sign system turned out to have positive responses, and that the sign system using isometric was easily recognized. In addition, the complaints and shortcomings to be improved were examined and considered in creating the new prototype in the experiment. As a result, all subjects felt that the interactive guide sign system is essential. In conclusion, the

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[10] President & CEO, GA-TAP Corp. (2007) International Symposium of KSDS, South Korea, May 29

existing general hospital guide sign system should be changed to the interactive sign system that can deliver the accurate information to users.

6. FUTURE STUDY ISSUES

This study is focused on grasping the problems of the guide sign system of general hospitals, and presenting a new design to solve those problems. Besides, the significance of the prototype used in this study is to solve the problems of the existing sign system, and present an interactive sign system in line with this ubiquitous era. Although it is at the beginning stage, as the technology develops, various types of sign systems will be come up with. In future study, the location characteristics of general hospitals and the sign system that is used to easily grasp the major users' ability to recognize and easily understand the complicated procedure should be examined with consistent interests. It is expected that investigation not only on the design but also various factors involved will contribute to the more effective sign system development.

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