

Proposal of Cloud-Based Women's Healthcare System Using Ubiquitous Network

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Abstract: The World Health Organization promotes e-Health, which is the use of information and communication technologies for health. However, in countries which use Chinese characters, there is a relatively short history since the establishment of keyboards that supported these character systems, and this is resulting in delays in the popularization of e-Health. In these regions, it is desirable to utilize systems to use the ubiquitous terminals which can be used by simple screen operations without requiring the use of a keyboard.

Therefore, We have already built a cloud-based Health Management System for old person using tablet terminals, which are ubiquitous terminals free of keyboard operations and proved its effectiveness. This system is a health and medication management system for old person which automatically collects vital signs from vital sensors such as blood pressure gauges, body temperature gauges, body composition gauges and physical activity gauges, connected wirelessly to a ubiquitous terminal Bluetooth or NFC, saves such data automatically to a cloud server, and enables the old person to independently improve their health and prevent disease for their healthy advanced ages.

In this paper, we consider the application of the above-mentioned cloud-based Health Management System for old person to Women's Healthcare. As a result, we propose a promising mechanism that we think will be effective for the Women's Healthcare and that exploit an existing cloud-based Women's Healthcare portal system, which is a system that saves health records to a cloud server and enables various applications of such data.

We describe such a mechanism, evaluate its effectiveness as the Women's Healthcare by opinion score tests, and the necessity of building a cloud-based Women's Healthcare system which is the integration of both systems and uses ubiquitous network.

Keywords-- Ubiquitous network, Cloud service,
Tablet telephone, Women's Healthcar

1. Introduction

By the World Health Organization, all people throughout the world should maintain a satisfactory condition of health, both physical and mental, and it is promoted utilization of information technology including the Internet as e-Health to provide information and services which are useful in health promotion [ref.1].

However, in countries which use Chinese characters, there is a relatively short history since the establishment of keyboards that supported these character systems, and this is resulting in delays in the popularization of e-Health.

Accordingly, in these regions it is desirable to utilize systems to use the ubiquitous terminals that can be used by simple screen operations without requiring the use of a keyboard. In this study, consideration and verification were carried out with regard to a cloud-based Health Management System (known below as the Health Management System) that was built taking these types of regional aspects as preconditions. Specifically, verification is carried out taking Maebashi City which is a core Japanese city formerly known for its silk production located a little over 100km north of Tokyo, as an example.

In Maebashi City, for local problems such as health, economy, the employment, we built "Maebashi ICT Silk Project" for the purpose of solving it by ICT using the tablet terminal where keyboard operation was unnecessary. The project was carried out about the health, a cloud-based Women's Healthcare Portal (known below as the Women's Healthcare Portal) was built. This portal enabled grasp such as the information of the vaccination, the consultation information of the medical institution by consolidating health condition and a taking medicine history before dying from birth. The final aim of this portal is effective treatment and reduction of medical related expenses. The first step to realize this was to build a unified management system for the health information relating to children from the time of birth until their graduation from elementary school. First, IC cards were given to mothers with children who were cooperating in the evaluation of this system in order to provide them with the authorization necessary to enable them to use the system, in other words, for personal identification. Next, by establishing their personal portal sites with their IC card, they were allowed to use contents such as physical records of the mother from the beginning of pregnancy to childbirth and of their child after birth, inoculation records, and electronic medical records.

Meanwhile, effective health management could be realized by applying the Health Management System that was developed, which uses a tablet phone ubiquitous terminals that automatically measures and manages a person's vital signs including body weight and blood pressure. This has been confirmed using field trials targeting elderly persons, and the validity of the system has been verified [ref.2].

In this study, it was determined to apply the above-mentioned Health Management System to women's healthcare. The Health Management System, which automatically measures the mother and child's vital signs (body weight, pulse, and blood pressure), has been built by us. It uses the GRANYC Android tablet phone (known below as the tablet phone) developed which supports use of

the Hikari high speed optical fiber Internet connection service and can be installed in ordinary homes. This Health Management System was originally built as a system for implementing health management and medication management by independently carrying out health promotion and prevention of illnesses to enable elderly persons to enjoy their old age in good health. However, because it was believed that the system could also be applied to women's healthcare by linking the Women's Healthcare Portal with the health management function of this system, field trials were conducted to confirm the necessity and validity. Further, physicians had already suggested the necessity and validity of a medication management function for mothers with children. However, because the main objective of this study was to confirm the validity and necessity of integrating both systems, it was decided in this study to apply only the electronic medical record information of the Women's Healthcare Portal this time, and to set the investigation of the physicians' suggestion as an issue for the future.

In this paper, evaluations were carried out regarding the linking of both systems, and investigations were carried out based on these evaluations to determine the ideals for Women's Healthcare Systems using ICT in the future. In the evaluations, nine mothers with children who had been invited to participate in the Maebashi ICT Silk Project were given introductions to both systems and were provided with an opportunity to actually use the machines. In addition, two mothers as monitors were allowed to utilize the system for a fixed period, and together with the results obtained by conducting interviews with two MD, confirmation was made of the necessity and validity of linking both systems. Below, explanations are given of the confirmation methods in section 2, and of the evaluations and results in section 3, while consideration is made of the evaluation results in section 4, and a summary of this paper is given in section 5.

2. Methods

The evaluation was carried out by linking the personal Women's Healthcare Portal site using IC cards created in the Maebashi ICT Silk Project, with a Health Management System (Figure 1).

The Health Management System is linked to the Women's Healthcare Portal site using a tablet phone which automatically measures the mother and child's vital signs. The Health Management System consists of an Android application that allows use of various health management and medication management system functions by installing a health management application in the tablet phone, and a Health Management Server that enables management of the vital sign measurement results and setting information utilizing the Google App Engine (GAE) service provided by Google. The Health Management System comprises a health management function and a medication management function, and an explanation is given below of each function. In the health management function, the results of measurements made by the vital sign sensors such as weighing scales and blood pressure gauges incorporating Bluetooth communications functions are automatically sent to and recorded in the Health Management Server. The medication management function enables support of the measured person's medicine-taking using a medication confirmation function, remaining medicine confirmation function, a medication alarm function, and a notification mail function. Additionally, using the calendar function, all of the measurement results and the medication situation in a day can be confirmed. However, as described in section 1, in this study it was determined not to use this function.

In the system linkage in this study, it is possible to access both the Women's Healthcare Portal server and the Health Management System server using only one tablet phone. However, in the current situation, because the Women's Healthcare Portal and the Health Management Server have been built separately, it is necessary to access each of the systems separately.

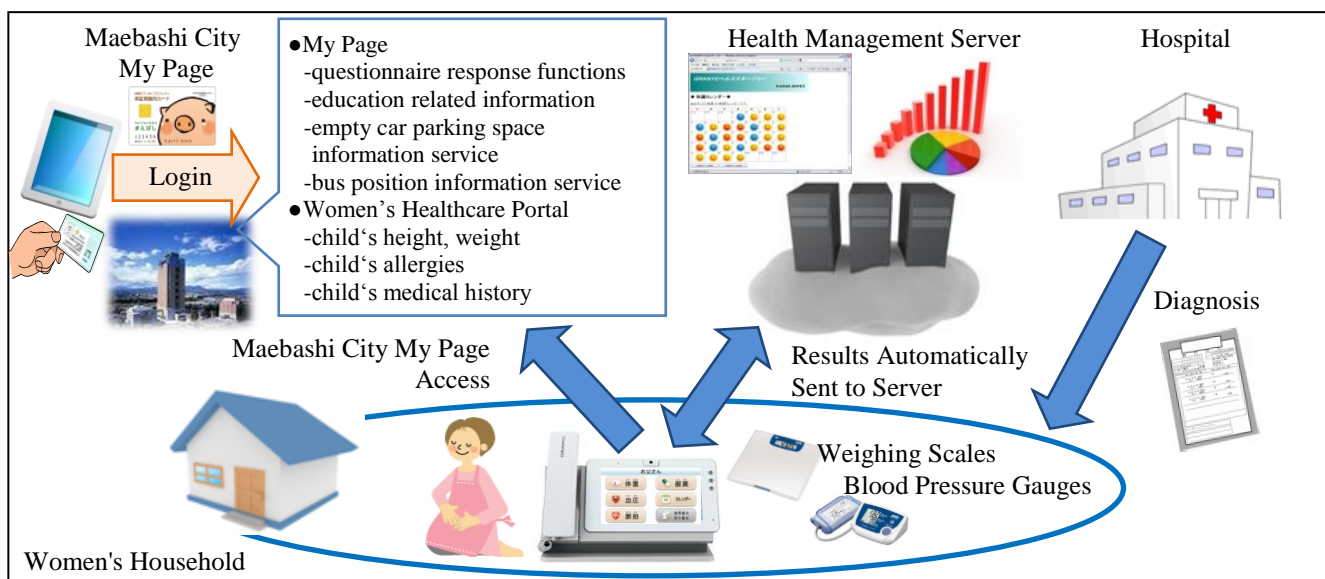


Figure 1. Configuration diagram of the Women's Healthcare Portal and the Health Management System

3. Results

With the purpose of verifying the validity of the Health Management System that had been linked with the Women's Healthcare Portal and confirming the remaining issues, evaluations were implemented by mothers with babies and by physicians who had been invited to participate in the Maebashi ICT Silk Project.

(1) At the childcare-related social gathering attended by nine mothers with children aged two to three months on February 20, 2013, an explanation was made of the Women's Healthcare Portal, and an introduction was given to the Health Management System, during which demonstrations were made of the actual machines. Afterwards, a questionnaire and interviews were implemented to carry out evaluation, and the participants' opinions were collected regarding the necessity of the Health Management System in women's healthcare and issues for its improvement. With regard to the questionnaire, in order to analyze the degree of completion of the women's healthcare in the Health Management System, a numerical representation was made using the contents of the question items (Table 1). Each item was given a maximum of five points, and the averaged results are shown in Figure 2 and Figure 3.

Table 1. Question Items

No	Evaluation: From 5: Good to 3: Normal and 1: Poor
1	Do you feel that a function for managing your body weight, blood pressure, and pulse is necessary?
2	How did you feel about the screen layout, the text size, and the ease of viewing?
3	How did you feel about the operability, including the touch operation and the ease of pressing the buttons?
4	How did you feel about the ease of viewing the graphs and figures that can be seen in the Health Information Service?
5	Was the operation up to the viewing of the information in the Health Information Service appropriate?
6	For the Health Information, it is possible to use the internet to show your daily condition during medical examinations. Do you consider that this service is effective?
7	Do you think that you would like to actually try using the Health Management Service?

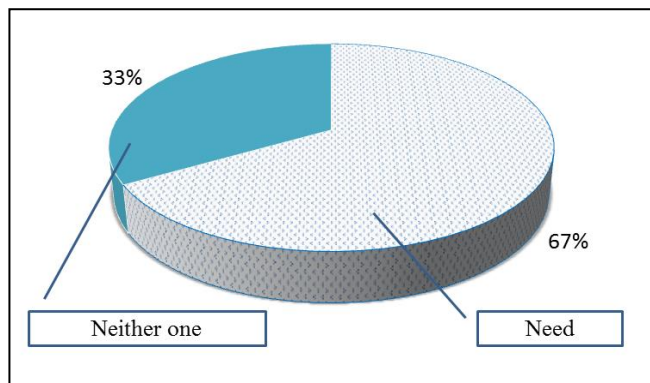


Figure 2. Necessity of Health Management System

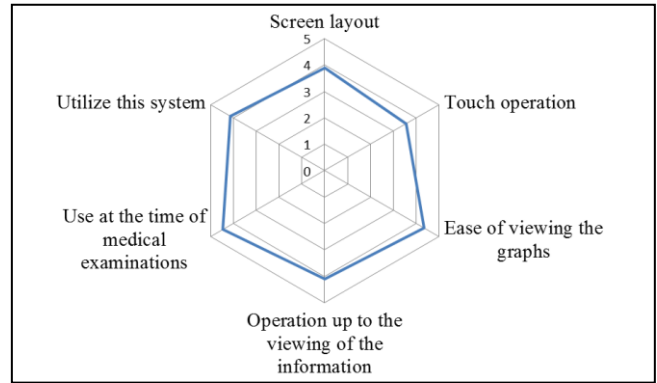


Figure 3. Evaluation of the Health Management System

60% of the mothers with babies responded that there was a need for managing body weight, blood pressure, and pulse in women's healthcare, and none of the mothers responded that this was unnecessary. In addition, in the questionnaire conducted after the explanation had been given of the system and the mothers had actually used the tablet phone, although a low evaluation was received regarding the screen operation, it was possible to confirm the necessity of the other items.

(2) Tablet phones incorporating the health management applications were installed and operated for an approximately one month period in the homes of two expectant mothers who were acting as monitors. Afterwards, interviews were implemented regarding the contents of the question items to collect the opinions of the subjects with regard to problem points and improvement points that they became aware of during the fixed period of operation (Table 1). These results are shown in Table 2.

Table 2. Evaluation of the Health Management System

Question Items	Expectant mother A	Expectant mother B
How do you feel about the necessity of health management?	Necessary	Would be good if available
How do you feel about the screen layout?	Good	Good
How do you feel about the touch operation and button operability?	Good	Good
How do you feel about the ease of viewing the graphs and figures?	Good	Good
How do you feel about the operation up to the viewing of the information?	Good	Good
How do you feel about being able to utilize your daily health condition information during medical examinations?	Convenient	Convenient
Would you like to utilize this system in the future?	Would like to utilize	Would like to utilize

(3) In the interviews with the two MD that were realized due to the cooperation of the Maebashi Medical Association, the opinions described below were obtained with regard to the Women's Healthcare Portal site and the Health Management

System. Since both physicians offered nearly the same opinions, their opinions were summarized and shown in Table 3.

Table 3. Results of interviewing the physicians

Item	Opinion
Favorable aspects	It is possible to confirm the person's vital sign information from home during medical examinations.
	In addition to elderly persons and mothers with children, the system might be able to be applied to all age groups.
	Depending on the situation, it will be possible to confirm the person's condition at their home by viewing the Health Management Server.
Aspects requiring improvement	For mothers with children, the measurement of body temperature is important, so it will be necessary to allow connection of a basal thermometer.
	The system consists of a Women's Healthcare Portal site and Health Management Server. Depending on the situation it is troublesome to view two servers, so it is possible that the system cannot be applied to our work.

4. Considerations

From the verification carried out this time, it was possible to confirm the necessity and validity of applying the Health Management System that was developed for elderly persons also to women's healthcare linked with the Women's Healthcare Portal. Below is a description of specific opinions and considerations.

In the interviews of the mothers with babies and expectant mothers, it is believed that the fact that many of those interviewed answered that it was convenient to be able to display their daily vital sign information during medical examinations and to have a physician confirm their health condition while at home indicates the validity of this study. With regard to the evaluation of the system, it is thought that the fact that the results of the evaluation items other than for the screen operation showed a high degree of satisfaction indicates the validity in relation to the practical implementation. Regarding the screen operation, this application was created for use by elderly persons and thus there was no problem with operability. However, it is thought that the unfavorable evaluation was received because persons from younger generations, who are used to operating smartphones, found the operation unsatisfactory. It is therefore believed that it will be necessary to resolve the problem such as by customizing the screens for the age group that is using it. As an additional problem of the screen operation, it is also thought that the complication with regard to having to separately access two systems was one of the causes of the unfavorable evaluation, and it is believed that this suggests the necessity of building one system by integrating both systems.

In the interviews with the physicians, in addition to requesting the connection of a basal thermometer similarly to the opinions given by the mothers with babies, the

importance was understood of providing a full lineup of vital sign sensors including basal thermometers based on the Continua Health Alliance standards which have the objective of allowing seamless communications with the tablet phone. Currently, investigations are made into the seamless connection of basal thermometers.

From the above, it was confirmed that efficient women's healthcare could be realized by linking the Women's Healthcare Portal with the Health Management System to apply the Health Management System to mothers with children. As can be understood from these verifications, and particularly from Table3, it was possible to confirm the necessity of building a system that improves the functional aspects without adding to the workload on physicians and without increasing the burden on mothers with children of applying the system.

5. Summary

By linking with the Women's Healthcare Portal, it was possible to confirm the validity of the Health Management System developed for elderly persons also for women's healthcare using field trials. Further, the necessity of building a cloud-based Women's Healthcare system which is the integration of both systems and uses ubiquitous network, was also confirmed from the field trials.

Going forward, the first stage will be the expansion of the services to cover women's healthcare that considers the full lineup of vital sign sensors and linkages with medical institutions. As well as further improving the convenience, such as by applying the system to commercially available smartphones, it is planned to build a Health Management System that contributes to health management not only for elderly persons and mothers with children, but for all the people throughout their entire lives. Furthermore, we increase the number of the monitors and are going to perform an accurate evaluation.

In addition, because the type of Health Management System described in this study, utilizing a tablet-type device ubiquitous terminals that does not require keyboard operation, has a compact device size, it will enable the provision of high quality services to all people, including not only elderly persons who are unfamiliar with keyboard use, but also persons who are accustomed to keyboard operation. Therefore, it is believed that this system can contribute to maintaining people's health as an e-Health system which can be used by people throughout the world, not just by people living in countries using Chinese characters.

References

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