

# Evaluation of Mobile Healthcare Communication System

Toshiyuki Maeda, Yae Fukushige, and Masumi Yajima

**Abstract**—This paper addresses a new healthcare communication system based on email communication, which is designed and developed from view of previous research results and problems. The system is an email-based communication independent with the sorts of terminals, based on mailing-list system and approved various communications by one-stop account, and offers users' availability for checking their own data which is reflected by every day's reply data, and daily mails have many variations because they are not automatically sent but nurses writes and sends every day, which let emails not routinely but humane and improved. We have evaluated the system by the operation test, where we have many important data and discussion.

**Keywords**—mobile communication, healthcare support, email-based communication, system evaluation

## I. Introduction

Health is essential for human to live a happy and pleasant life. People need to sustain the motivation to keep healthy habits. Research data by Japanese Ministry of Health, Labor and Welfare address that health consciousness of the Japanese people is getting higher and higher in these days. At the same time, however, the number of people who claim their health problems is increasing. This may be because the lifestyles of Japanese people change and that cause of the irregular life cycle and increase of stress, and then many people have health problems caused from lack of normal nutrition or activity, though high health consciousness. We insist that it is important to have adequate health consciousness.

[1] reports that university students who have high health consciousness make good health actions. Furthermore, health problems for aged people emerge more likely. We believe people should raise health consciousness in younger ages for preventing health problem. Overweight may not only cause into health disorder, but also affects future lifestyle, and so it is very important to care for weight. We focus on healthcare communication as preventing health disorder of student youth and improving "health literacy."

We have been researching education support systems [2,3]. We thus applied and improved these researches into the healthcare support system and have had some operation tests [4]. This paper addresses more discussion about other operation test results, especially questionnaire analysis, and evaluates the system.

## II. Related Works

There are some researches for health care support systems. [5] researches and develops health care system in universities using Web and mobile system. [6] studies calories management for health care support using mobile phone applications. Those systems, however, have problems for our targets as system complexity for various carriers, lack of health consciousness of nutrition, and lack of communication between students and health office.

System complexity for various carriers causes from Japan-specific matters. In Japan, there are some carriers, which have many sorts of mobile phone types and little compatibilities for contents service. For that reason, we have to pay the tremendous cost if we support all types. We thus introduce a generic mail-based communication system that can support almost all mobile phones.

Furthermore, our system supports not only mobile phone terminals, but also other equipment (PC, PDA, and so on) which can send and receive emails, and that leads various approaches by various equipment. We design to operate the system only by normal emails, and that means users need not to learn how to use additionally, and so the system can be regarded as easy-to-use, lightweight, and generic.

In Japan, so-called "recording diet method" (RDM) is one of popular diet methods. We expect RDM effect by sending plain-text emails written by students themselves. The method is to lead dietary effect for users by recording their daily meal data, and then reinforcing consciousness of caloric intake. For instance, [7] researches a recording system of caloric intake by taking and saving each meal pictures. [8] develops a Web-based RDM system and examines operation tests. This system is expected to improve casual human communication by forcing students to describe health management data and to send mails. [9] explains that students who have moderate dietary and physical exercise habits tend to be tolerant to stress and emotional control, and interventional supports for personal stress and lifestyle is an effective method to train self-management of health care activity.

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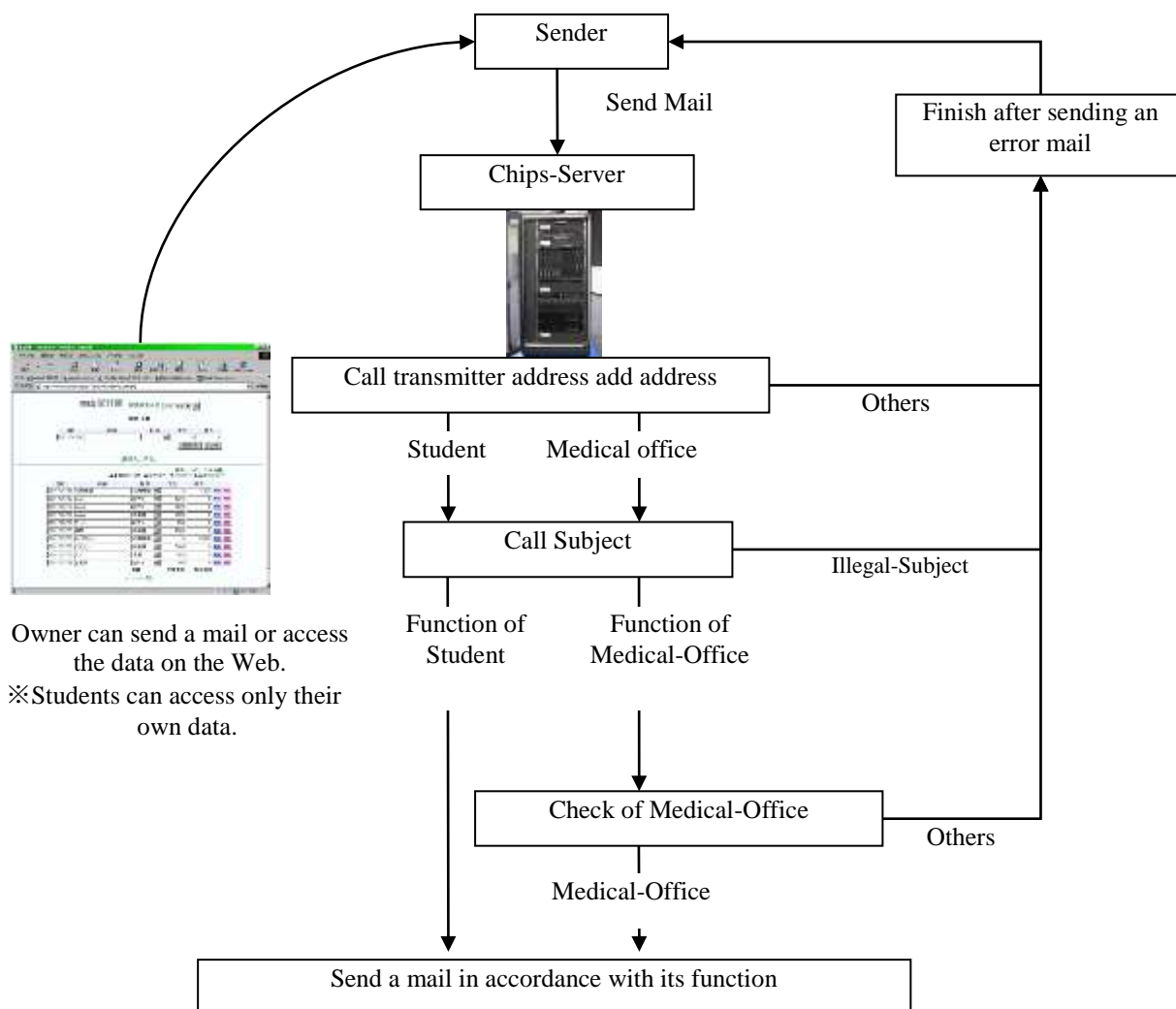
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We discuss these matters, and then attempt interventional support to users with frequent communication. We express features and effects of our system, and discuss operation test results.

### III. System Features

Our new system is designed and developed as follows (see Figure 1);



**Figure1: System flow.**

**Table 1: Operation test results.**

All participants		25
Return rate	Average	31%
	Max.	59%
	Min.	15%
Weight up/down rate	Average	-0.29kg
	Max.	-5kg
	Min.	+3kg
Numbers of input characters (all)	Average	58.5
	Max.	989
	Min.	2
Numbers of input characters (as for free format)	Average	18.9
	Max.	907
	Min.	0
Free format ratio in questionnaire (Average)		87%

- Email text-based communication independent with sorts of terminals
- Based on mailing-list system and approved various communications by one-stop account
- Users' availability for checking their own data which are reflected in every day's reply data
- Daily mail variation which is not automatically sent but nurses writes and sends every day, which let emails not routinely but humane

Each mail to students are not automatically delivered, but written and sent manually by nurses, and that lets mails warmhearted, and that may avoid boring with the system. At the same time, we try to send personal mails more frequently. For instance, we have short advices to students who do not reply frequently, or have irregular meals. Furthermore, we modify the questionnaire; For instance, the last item "Tell the good thing of the day" is changed to a vague question "Tell any message or just a tweet" which is easier for students to write down.

We have a operation test for students as follows; Firstly, we collect health data (weight, caloric intake, physical exercise, etc.) through email communication. Secondly, the server analyzes the data and classified into the database. Thirdly, the medical office checks the database and makes some advices respectively if required.

#### IV. Results and Discussion

We have had feasibility tests and got some research results. In this test time, test subjects are regarded as those who reply more than two times, including students of very few replies during the test period.

In this test, there are few students who reduce weight very much. Reply rate is, however, much raised rather than our previous test.

Weight change of students varies from -5kg to +3kg. In general, students who frequently reply seem to reduce weight. Moreover, according to hearings after the operation test, even students who rarely reply do not ignore emails from medical office but just read those. Those imply human-written mails promote reading mails, and by those mails, students feel a tight connection to the medical office and so they may be relieved. We believe that is a main reason for improving reply rate, as students evaluate emails fairly good.

Freely-formatted message (included in the last part of the questionnaire) fills about 87% of all mails. Among those, quite many mails are not concerned with dieting but just with student life. We assume the message communication may be more important to a kind of mental health care matters.

For further investigating, we analyze the questionnaires using text-mining method. We introduce correspondence

analysis combined with token analysis (see Figure 2, originally in Japanese and translated in English).

For analysis purposes, we categorize students into 3 classes:

- "minus" : students who reduce weight over 2kg.
- "fair" : students who reduce weight under 2kg.
- "plus" : students who gain weight.

This figure shows some correspondence with "minus" students with the words "reduce", and with "plus" students with the words "save", though those classifications are not so clear. We have to investigate more precisely.

#### v. Conclusion

We have developed a healthcare communication system and evaluate the system by the operation test, where we have many important data and discussion. In the near future, we will analyze the results more precisely, including data-mining methods. We may find nature properties of the laws and then improve the system. For instance, an inspiration mail is sent to who does not reduce weight well, or does not reply so frequently, and the emails may enforce consciousness to the student.

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**Figure2: Correspondence analysis of questionnaires.**

