F-Mail Communication System for Users with Disabilities

Tetsuya Hirotomi and Nikolay N. Mirenkov
Graduate Department of Information Systems,
The University of Aizu,
Aizu-Wakamatsu City, Fukushima 965-8580, Japan

Abstract: - F-Mail communication system to support e-mail like communication of users with disabilities is presented. This system is a part of a more general multimedia communication environment based on self-explanatory component and multiple interface concepts. In this paper, an introduction of the self-explanatory component, a detailed explanation of human-system interactions, and an overview of database tables for storing the components are provided.

Keywords: - E-Activity, People with Special Needs, Self-Explanatory Component Technology, Multiple Interface, Multimedia for Communication, Multiple View, Multimedia Message, Multimedia Hieroglyph, Multimedia Word

1 Introduction

In the last three decades, computer mediated communications have been known and used by a variety of people. Because of the Internet, computers can overcome space and time gap of human communication. It means, computers provide furthermore communication opportunities for people. Communication is a key of QOL (Quality of Life), so computer users may have the better life than others. However, the computer mediated communication is still standing on, in many cases, the text medium. Sending/Receiving e-mails is a typical example. That is, people should be able to express their knowledge, feelings, emotions, etc. in text format with typing keyboard, and understand the meaning of texts in order to have the better life. These requirements prevent some groups of people (including people with some level of mental/physical disabilities, elderly people, and children) to be users of e-mail software and other software for the computer mediated communications.

To support such people, a number of technologies has been developed. These technologies can be classified into four groups. First group is for editing/writing texts, for example, spelling checkers, grammar checkers, and word-prompt programs which provide lists of suggested words based on some prediction. Second group is for converting text into other media/languages and vise versa, for example, speech processing (dictation, synthesis, etc.), language translation (English to Japanese, etc.), and other machine translation technologies (hand signs to text, text to braille text, etc.) [2, 3, 5–7, 11]. Third group is for replacing text by visual symbols and/or attaching them to support understanding the meaning of text, for example, Picture Communication Symbols, Rebus Symbols, Picsyms, DynaSyms, Pietgram Symbols, and Blissymbolics [8, 9, 12, 13, 15]. Fourth group is for using extra-ordinary human-computer interaction devices to manipulate text, visual symbols, etc. instead of typing keyboards and watching monitors, for example, a touch-enabled or force feedback devices, foot mouse, eyegaze system, etc. [1, 4]. Many of them are rather independent and are considered for a very specific group of people. So, a new communication environment is requested by the diversity of users to organize and use these technologies effectively. However, text oriented representation of objects and processes is a bottleneck to realize that, because it shows only a few features of objects and processes. It is very complex (and sometimes impossible) task to extract necessary features from text and use them in different technologies organized.

That is why, we are developing a new multimedia communication environment, so called “F-Communication System (FCS)” [10].” It is based on
self-explanatory components and multiple interfaces, as a result, it has a potential to organize assistive technologies, effectively. Our components are collections of views representing many feature of objects and processes (in this way, self-explanatory features can be reached). These views can be selected and used in different technologies, and the interfaces provide further adaptation for accessing, browsing, and manipulating the components. Such selection and adaptation is based on user/device profiles and special statistics. And also, the manipulation can be performed only by simple mouse click operations. It means the user can use foot mouse, touch panel and other pointing devices depending on his ability. In this way, the FCS becomes, in a sense, a usable system for everyone (during the development, we evaluate the system usability by regular contacts with teachers and students in schools for physically handicapped and mentally retarded children and in a school for blind, independent professionals, and a cerebral palsy patient’s family). The FCS consists of a number of parts. Each part shares an online database to store the components, but can be considered as an independent system.

In this paper, we present the implementation of a part, named “F-Mail Communication System.” It supports e-mail like communication for users with physical and some mental disabilities (we hope this system can attract other users, too). An introduction of self-explanatory components, interactions with F-Mail system panels, and a brief overview of database tables are described. Special attention is paid to explaining a prototype of F-Mail system by its screen images.

2 Introduction of self-explanatory components

Instead of writing (typing) e-mail texts, the users create multimedia messages in a language of pictures. This language consists of self-explanatory components: multimedia sentences (hieroglyphs) and multimedia words.

A multimedia message is a sending/receiving unit comprising a cover page and some content pages. Fig.1 shows a structure of the message. A cover page contains pictures of sender, receiver, and some other information related to a message. Each content page comprises a stencil and a set of multimedia words and hieroglyphs. A stencil has a background image and predefined positions to arrange a set of the words and hieroglyphs.

A multimedia hieroglyph is a representation of a sentence. It has six cells to answer 5W1H questions: who, what, where, when, why and how. Furthermore, each cell has seven predefined sub-positions to make a hieroglyph more precise. More to the point, writing a sentence in the FCS can be done by answering corresponding questions by simple mouse click operations. We developed and analyzed a variety of hieroglyph formats [14] and finally come to a uniform structure in Fig.2. It shows multimedia hieroglyph cells with a full set of sub-positions.

Figure 1. Multimedia message structure

Figure 2. Multimedia hieroglyph cells and their sub-positions
A multimedia word is a multiple view representation of a word. Each view shows at least one feature of information represented by the word. In the FCS, a “basic view” (a caption and a standard image) of the word is used instead of abstract symbols in other symbolic communication. For example, the bottom right of Fig.1 shows the basic view of “working.” If such a view is not enough to understand the meaning, users can ask the FCS to provide “additional views” for more detailed explanation, for example, the explanation by animation, video, sound, and toy/robot motions.

3 Interactions with F-Mail panels

To manipulate self-explanatory components and send/receive them as multimedia messages, a number of F-Mail panels are designed and implemented. In the design process, a special attention has been paid to reduction of a number of clicks and buttons. In this section, visual explanation of the system panels is presented in detail. It is worth mentioning that all operations can be done only by simple mouse clicking.

![Figure 3. Entering F-Mail system](image)

The user must login the system (Fig.3). First, he should select his face from column A, then select his pass-pictures from column B and C instead of typing a password. Previous and next three candidates for the selection will appear after clicking triangle buttons at the top and bottom of each column, respectively. After that, he can click login button in column D to verify the pass-pictures combination. The character located between column C and D is a “screen pet” for leading and entertaining the user. For example, if the combination is correct, he will jump to cerebrate a successful login. But if it is wrong, he will regret with shaking his head.

![Figure 4. Reading a new message (cover page)](image)

After the login process, the user may check new messages received (Fig.4). Row A is to switch the lower part of the panel to corresponding modes: search, create, and quit. In this case, “search mode” is selected, and a new received message is automatically searched and shown in column D. Row E is to select a message and show its cover page in row F. If mouse cursor is in row F, the user can click a triangle at the top right of the row, and see the content pages. After that, a new set of triangles to see next, previous, and cover pages of the message will appear.

![Figure 5. Searching messages with three keywords](image)

If the user wants to see other messages, he can search them by three keywords related to message topics, history (sent, received and others), and sender/receiver. He can specify the keywords in col-
umn B and the messages matched are shown in column C. Often, the number of messages tends to too many for a single keyword search, then more keywords are needed like in Fig.5. In this case, only two messages are matched. The user can click messages in column C, and check the contents in column D.

**Figure 6. Copying a hieroglyph from a message**

If the user wants, he can click the middle button in row A and switch to “create mode” in Fig.6. In this panel, a new message will be shown in column C and created through the following operations:

**copy a message:** The user can select a message from row E, and use as a template of his own message. If necessary, he can search other messages in search mode.

**copy from a message:** The user can select multimedia words and hieroglyphs from row F and put them into corresponding places of the message. Fig.6 shows copying a hieroglyph from the message selected to the place selected in page 1 (column C).

**copy a hieroglyph:** The user can select a multimedia hieroglyph from column D and put it into a corresponding place of the message. To reduce the number of clicks, the “best” 12 multimedia hieroglyphs (the number of hieroglyphs are parameterized) are selected automatically depending on the rank (priority) calculated by statistics and a special formula. If the “best” selection is not enough, the user can search other hieroglyphs in search mode. Keywords are related to hieroglyph topics, history, and words used in the hieroglyph. Fig.7 shows copying a hieroglyph from a “best” selection to the place selected in page 1 (column C).

![Figure 7. Copying a hieroglyph](image)

**copy a word:** The user can select a multimedia hieroglyph from column D and put it into a corresponding place of the message like “himeji jo (Himeji Castle)” in Fig.7. Similar to **copy a hieroglyph**, the “best” 27 multimedia words are selected automatically. If the “best” selection is not enough, the user can search other multimedia words in search mode.

**delete:** The user can delete multimedia hieroglyphs and words in his message by clicking them.

**delete a current page:** The user can delete a current page shown in column C.

**select a stencil:** The user can select other type of stencils from column D and set to a current page shown in column C.

**edit a hieroglyph:** The user can edit a hieroglyph or create a new hieroglyph in the position selected. Fig.8 shows creating a new hieroglyph in column C.

The user can edit a hieroglyph in Fig.8 through the following functions:

**copy a word:** This function is almost same function mentioned above. The difference is to filter multimedia words in column D depending on a hieroglyph cell as shown in Fig.9.

If the user wants, he can search other multimedia words in search mode by specifying keywords related to word category, history, and hieroglyph positions to be used. Fig.10 shows searching
multimedia words which used in where cell and classified into “public places” category.

In this case, the user selects “hospital” in column \( C \) and put it into column \( D \). Then he returns back to “create mode” and put the word in “where cell” of the hieroglyph in Fig.11.

**attach micro-icons:** This function is to attach multimedia words for sub-positions in a hieroglyph. Attaching multimedia words can be done as same as editing a hieroglyph as shown in Fig.12.

**apply:** This function is to finish editing and go back to “creating message.”

After creating his message, he can click a top right triangle in column \( C \) to open the cover page. If he filled out “topic” and “receiver” of the message, he can click a button in column \( B \) to send the message (Fig.13).

By the way, if the user wants to know the word meaning, he can click the screen-pet and the multimedia word. And then the screen-pet provides multiple view explanation of the word (Fig.14).

F-Mail system can adapt its interface for different people, because the number of GUI components on the panels, search results, etc. are parameterized. In this way, F-Mail system supports the implementation of our multiple interface concept.

**4 Overview of database tables**

To implement the above mentioned features in F-Mail system, 20 database tables have been implemented. They are classified into two types. One is for managing information to access, browse, and manipulate multimedia words, hieroglyphs and multimedia messages. Another is for managing information about users and their activity statistics to adapt interface and search mechanisms, as well as to select suitable view explanations of self-explanatory components. For example, creating new words requires at least one picture and an English/Japanese caption for each word. And then additional information, such
as English/Japanese captions for children, short text, animations, and other multimedia data, can be registered into the tables, too. Also, these tables are to support cross-cultural substitution of word views. For example, according to the user’s profile, some Japanese oriented pictures can automatically be replaced by international oriented pictures when sending/receiving multimedia words.

5 Conclusion

F-Mail communication system, a part of a new communication environment, has been presented. This system is an implementation of self-explanatory component and multiple interface concepts. It is reached by multiple view representation of objects/processes, and special adaptation of interface for people with special needs. Preliminary tests of the system showed promising results and effectiveness of the approach for creating new communication systems with a high level of usability.

References: