Development of a Image Processing Software supporting collaborative works with thematic maps. [1]Manabu Kanzawa, [1]Naru Hirata, [1]Hirohide Demura, and [1]Noriaki Asada, [1]Dept. Computer Software, The University of Aizu (Aizu-Wakamatsu, Fukushima 965-8580 Japan , e-mail address: s1110068@u-aizu.ac.jp)

Backgrounds: The aim of this research is development of an online conference system that supports collaborative works on planetary missions. This system has an applicability on collaborative analysis of planetary remote sensing data, and productions of thematic maps from these data by researchers remotely placed at their own home institutes.

Many lunar explorations are planned to be launch in and after 2007. Japan also will launch SELENE (Selenological and Engineering Explore) in the summer of 2007. These missions will obtain a large amount of remote sensing data. For example, raw image data from cameras on SELENE will be over 2 TB, and the amount of derived data products such as digital terrain models, mineral maps, and element distribution maps will be over 20 TB. Although the derived data sets are calibrated and georeferenced, they are not final products of the project. Many kinds of thematic maps will be produced after analysis and discussions on the data. Usually, the thematic maps are products of face-to face discussions and conferences. Researchers gather with tentative results of their analysis, and discuss on key issues of their specific projects. Finally, the results of the discussion are summarized as a thematic map. Online conference could be an alternative that replaces this traditional style of scientific discussion. Participants of the online conference can join a discussion at their own home institute without any waste of time and travel expenses.

There are many existing systems or software solutions of the online conference from simple instant messaging tools to large video conference systems. However, they are developed to satisfy a general purpose of common meetings, and not adequate for the scientific online discussions on the planetary remote sensing data. On the other hand, most existing applications for image data analysis are stand-alone software, not supporting the online collaborative operation. Here we propose a new communication system that is particularly focused to support collaborative analysis and discussion on the planetary research field.

System Outlines: Requirements of this system are summarized as follows: (1) Text based real-time communication between authorized participants of the conference, (2) Sharing a common display of target raster data by the participants, and (3) Functions for image manipulation on the displayed raster data including scroll, overlay by vector graphics, and general image processing functions, (4) Recording logs of discussion and related display manipulations. To fulfill these requirements, we developed a system based on the client-server model with Java. Fig. 1 shows a snapshot of the client of the system. The system diagram is also shown in Fig. 2. The client-server model has much advantage to development of the system. All data are controlled at the server side, and consistency of the data is simply kept by the server. The amount of the data that handled with the system is very large, so it is appropriate that they are stored in the server with a management by the large-scale database, and distributed to the clients on demand. The real-time communication between the server and the clients is implemented with socket connection, of which API is provided by the Java 2 Platform, Standard Edition, version 1.5.0_03.

Once a connection between the server and a client is established, the client gets a log of the conference to join the proceeding conference from the server. Therefore, a new participant can join discussion with the display synchronized with other participants. All manipulations on the client-side are sent to the server as commands, and stored in the log. They are also transferred to all other clients to synchronize the displays in real-time. In case of image processing command, Image data are generated on the server side. They are transferred in the same way.

Because the target image is usually large compared with a window of the client application, only a portion of the image is displayed within the window with scroll bars. Each participant can move a displaying area of the image as one's discretion. On the other hand, any participants can issue a command to forcedly synchronize the displaying area of all clients. The clients also have functions for image manipulation that are common on applications for image, such as band math and contrast/brightness adjustment. The user can draw overlay diagrams on the displayed image to point a region or a feature of interest of discussion to the other participants. All local manipulations are sent to the server, then each client application redraws the window with commands from the server. These functions are implemented to port the standard work-flow on production of thematic maps from offline to online.

Conclusions: We propose a new concept of the online conference system for collaborative analysis of planetary remote sensing data. It supports discussion between researchers remotely placed at their own home institutes to produce thematic maps of the moons

and the planets. To demonstrate this concept, a prototype system is developed with Java. The system work with the client-server model to keep consistency of the data. The system will be capable to maximize scientific return of large planetary exploration missions, such as SELENE.

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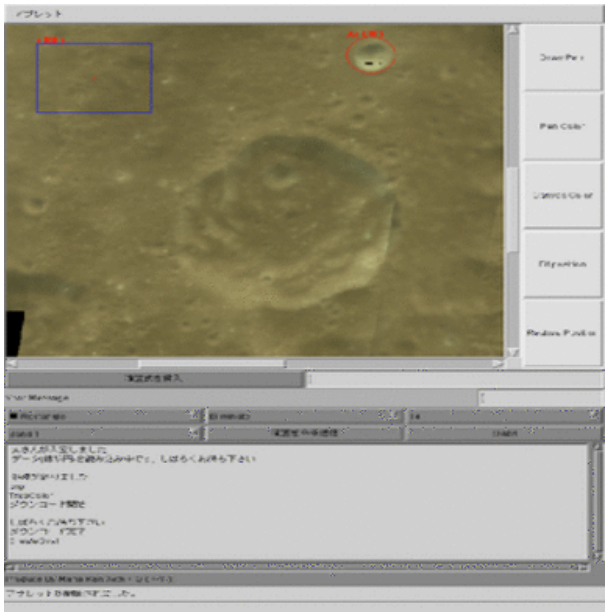

Fig. 1. Snapshot of the client application of the system. A target data is displayed within the window of the application with a text-based discussion board and buttons for image processing functions. Any participants can draw overlay diagrams that share all client displays.

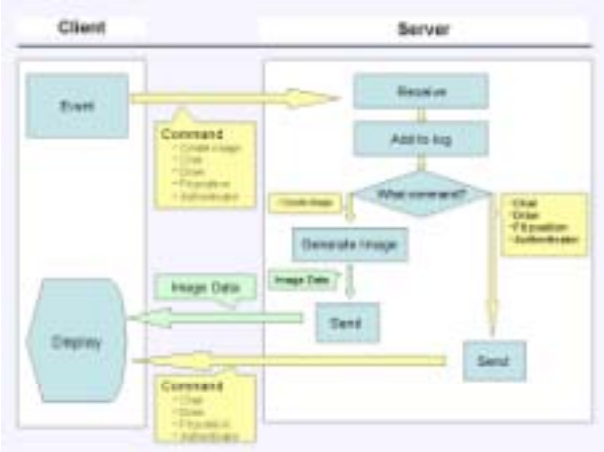

Fig. 2. Block diagram of the system