I-MODE CELLULAR PHONE ACCESS TYPE CROP PROTECTION SUPPORT SYSTEM "PADB"

T. KOUNO, T. MACHIDA

School of Agriculture, Ibaraki Univ., Chuou 3-21-1, Ami, Inashiki, Ibaraki 300-0393, Japan
E-mail: ad7127a@acs.ibaraki.ac.jp, machida@agr.ibaraki.ac.jp

ABSTRACT

In March 2000, we first developed an integrated database system called “PaDB" for the purpose of supporting preventive work for crop diseases and pests. The system is composed of three special databases --plant protection guidebook, illustrated book of crop diseases and pests, and agricultural chemicals catalog-- and a retrieval interface system that integrates these databases. The purpose of this research is to establish the practical use of the PaDB system. More specifically, we performed experiments in: (1) developing a retrieval interface that can be used with an i-mode cellular phone; (2) placing distributed databases; and (3) adding a database of cultivation calendars. As a result, the PaDB system became feasible in: (1) retrieval of information on the farm; (2) linking distributed databases that have their own individualities together; (3) supporting preventive measures for crop diseases and pests.

INTRODUCTION

We developed the PaDB system to integrate databases, in support of preventing crop diseases and exterminating pests (T. Kouno et al., 2000). The outline of this system is shown in Fig.1.

The PaDB is composed of three special databases --a plant protection guidebook, an illustrated book of crop diseases and pests, and a catalogue of agricultural chemicals-- along with an interface system, through which any data can be retrieved from the databases. This retrieval interface system is developed in use of CGI script. Therefore, a WWW browser is required to use the PaDB system. Fig. 2 shows the screen on which the PaDB system is running. The window of the WWW browser is divided into three frames: crops are shown in the left frame, crop diseases and

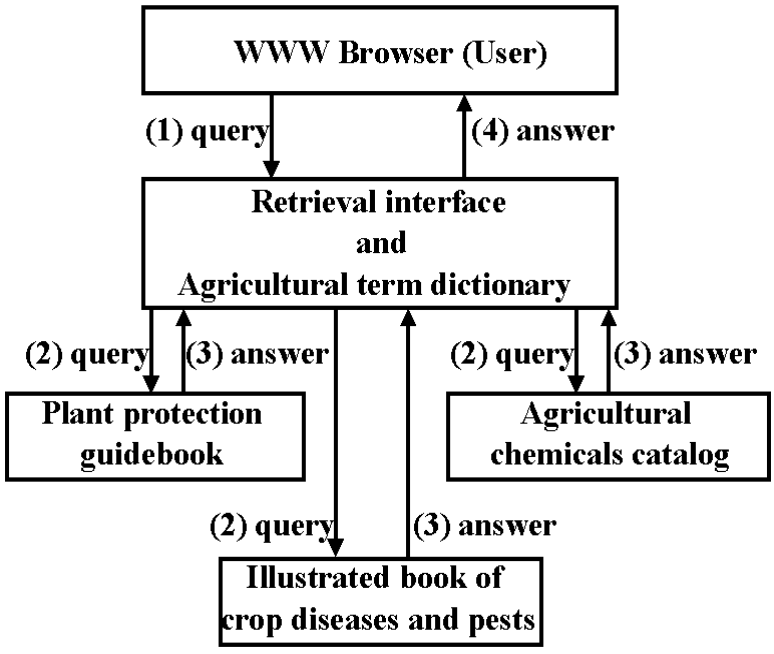

FIGURE 1. System structure of PaDB

pests are in the upper right frame, and a list of applicable agricultural chemicals is in the lower right frame. In addition, each frame includes further related information. Detailed information on crop diseases, pests and agricultural chemicals can be displayed in additional windows as the need arises.

FIGURE 2. Use example of PaDB

The test version of this integrated database system has been available to the public since March 2000. In November 2000, we developed a questionnaire whose results indicated this system was impractical, as shown in Fig. 3 (T. Kouno, 2001). This impracticality, for instance, resulted from insufficient data on the prevention of crop diseases and pests, and from the impossibility of retrieving information on preventive measures other than agricultural chemicals.

With this background information, we advanced in the study of the PaDB system with its practical use as our goal. More specifically, we performed experiments in: (1) developing an interface that can be used with an i-mode cellular phone; (2) distributing databases; and (3) adding a database of cultivation calendars.

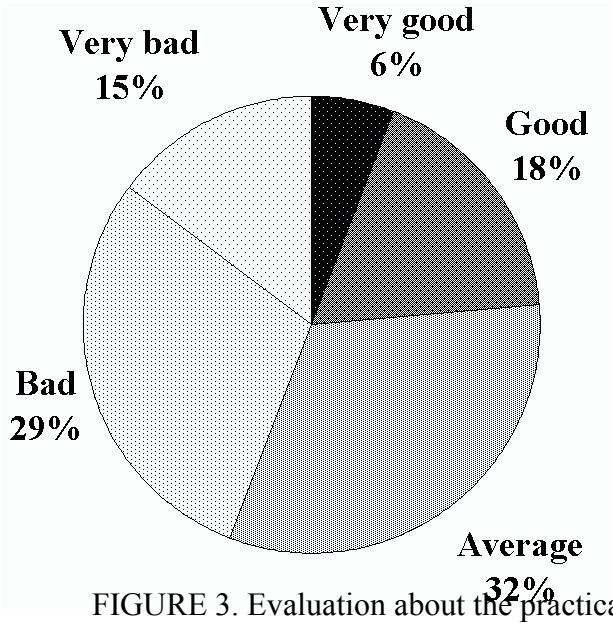

FIGURE 3. Evaluation about the practical use of PaDB

SYSTEM DEVELOPMENT

1. Development of the retrieval interface useable by i-mode cellular phones

A cellular phone is a very small information terminal that can be brought to workplaces on the farm. If the PaDB is accessible by this device from the farm, the retrieval action to prevent crops from disease and pests can be easily performed on-site.

FIGURE 4. Use example of PaDB from i-mode cell-phone

Amazingly enough, i-mode (NTT DoCoMo, 2001[1]) cellular phones, which are much smaller in size than PCs (personal computers) or PDAs (personal data assistants), have a WWW browser of their own. However, its efficiency is far behind in comparison with that of PC WWW browsers. In other words, the i-mode web documents must be drawn up in accordance with the i-mode compatible HTML (NTT DoCoMo, 2001[2]) that is an HTML subset. Unlike the PC browser, an i-mode browser has no frame functions, its display is small, and only a little information can be obtained at a time.

Therefore, we have developed a CGI script that outputs information retrieved in accordance with the i-mode compatible HTML. Each of the frames on a PC screen, for example, can be displayed in sequence on one single cellular phone screen at a time. Furthermore, if the information exceeds the displaying capacity of a cellular phone, it can be divided into a certain number of pages applicable to the cellular phone screen. The image files for crop diseases or pests are minimized except for some of their specific parts.

As a result, the PaDB system has become accessible by i-mode cellular phones. Some examples in practical use are shown in Fig 4.

2. Distributed databases

The PaDB system will enable us to search through various databases integrated on the Internet. At present, however, each database is established in its own server but not yet a distributed one over the network.

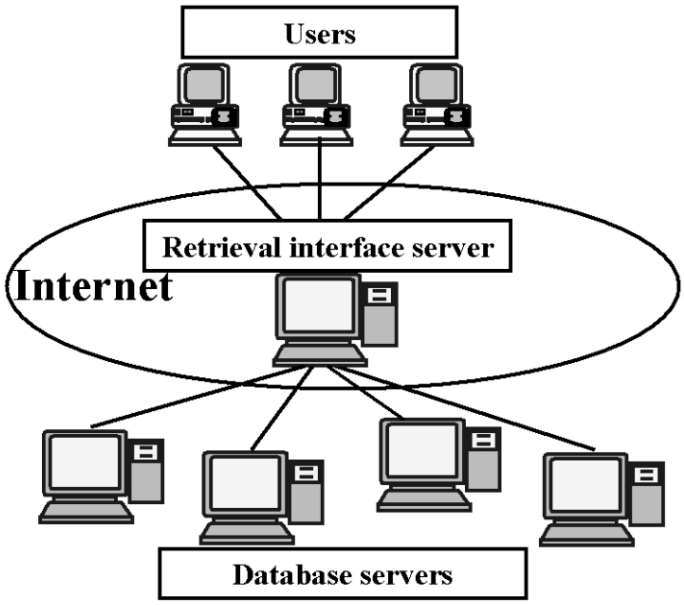

FIGURE 5. Outline of the distributed PaDB

If the distributed database system is put into practice over the network, specialized groups such as administrative bodies, researchers and agricultural chemical companies will directly administer their databases in their own fields. In other words, the individuality of each database in this distributed database system

can be easily maintained and its data can be more frequently updated in comparison with an intensive database composed of various data from many fields.

Based on respective specialties, we distributed databases, composing the PaDB system, into WWW servers that run with Linux (OS), Apache (WWW server), and some server side scripts (including CGI script or Java-servlet.) Moreover, we improved the retrieval interface system to be used in this operation. The summary of this system is shown in Fig. 5.

Example of the retrieval process is shown in Fig. 6. The retrieval interface (diseaselist.cgi) interprets queries from the WWW browser. If any data from the guidebook or illustrated book are necessary, the retrieval interface issues a query toward each retrieval module (guidebook.pm, illustbook.pm). In this case, the retrieval module makes suitable URL based on the query and the IP address of the database server, starts a script (guidebook.cgi, illustbook.cgi) of the database server, and acquires necessary data. Finally, the retrieval interface integrates retrieved data so that they can be shown on the display.

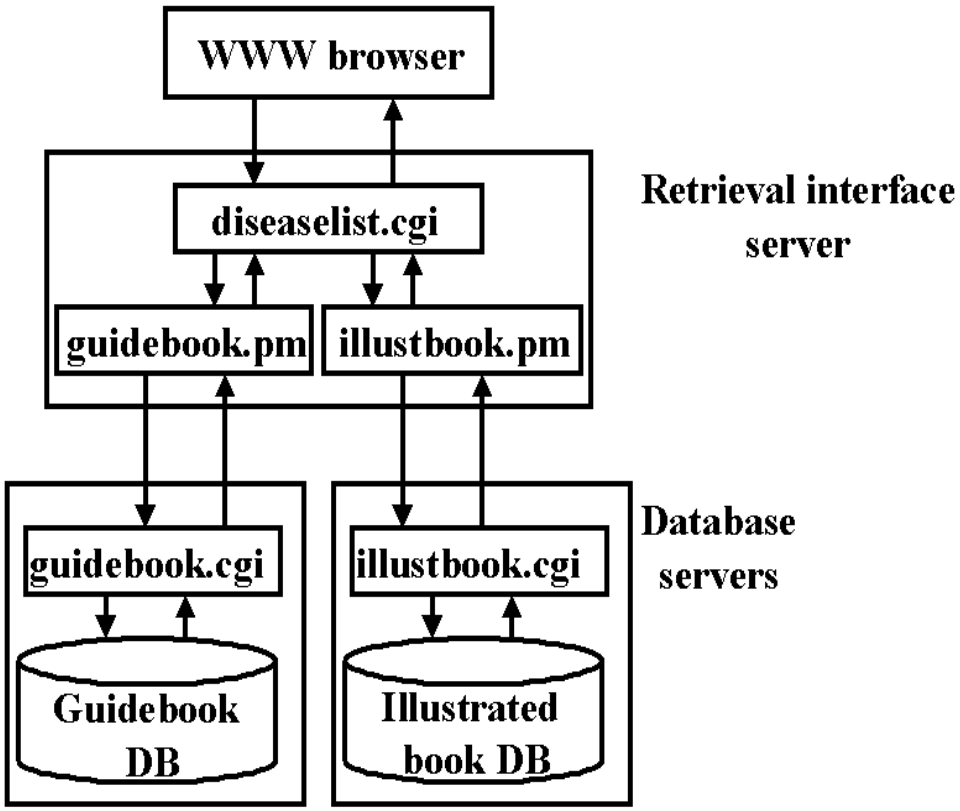

FIGURE 6. Example of the retrieval process

As a result of this, the PaDB has become a decentralized system over the network.

3. Addition of a database for cultivation calendars

The results of the questionnaire indicated that the PaDB had insufficient data in support of preventing crop diseases and exterminating pests. Therefore, we developed a cultivation calendar database added to the PaDB system to solve this problem.

More specifically, we set up a WWW server, exclusively used for cultivation calendars, running in the same way as the other database servers. In this case, we made it possible to retrieve information in use of a server side script. Furthermore, we finally added the cultivation calendar database as a retrieval object to the PaDB system and modified the screen composition.

As a result, we have come to retrieve updated and detailed information on crop diseases, pests, and agricultural chemicals based on preventive measures from the cultivation calendar database. The examples are shown in Fig. 7.

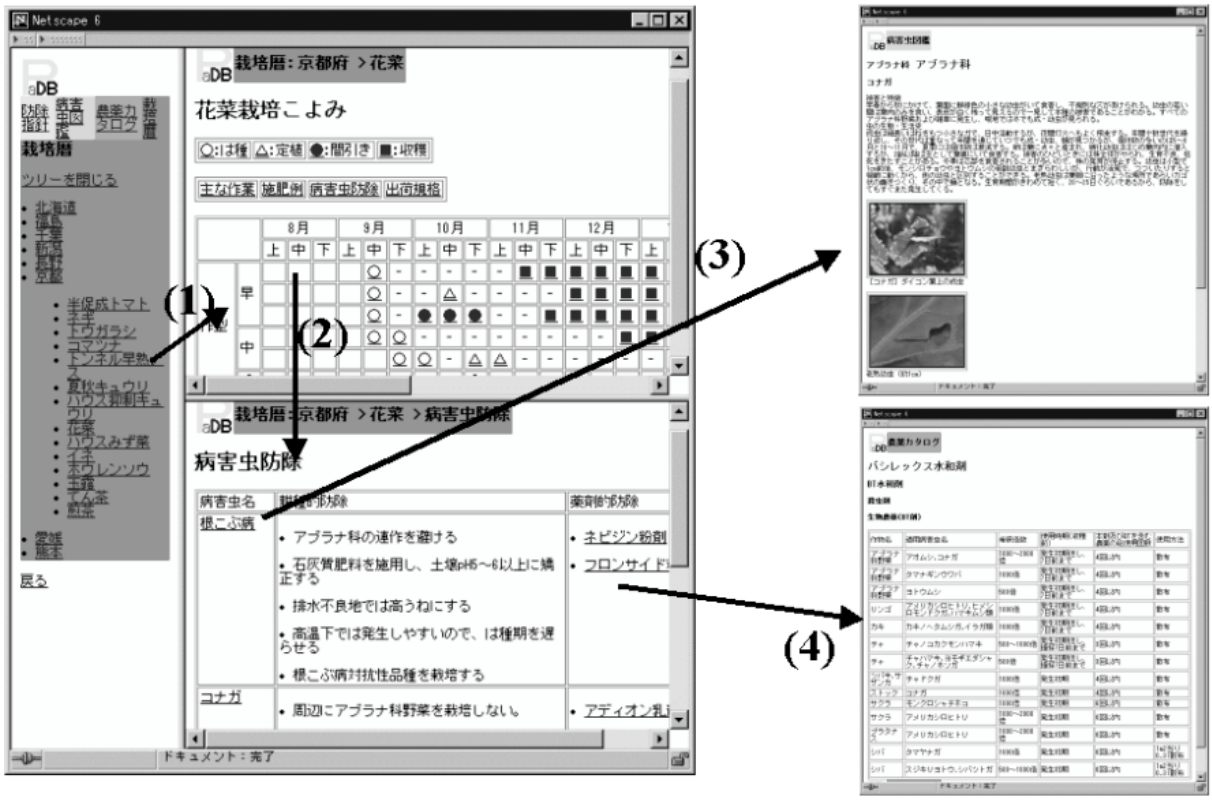

FIGURE 7. Use example of PaDB which a cultivation calendar was added

CONCLUSIONS

This study revealed the need for improvements in three areas to make the PaDB system more practical: (1) information retrieval in agricultural fields; (2) linking distributed databases that have their own individualities together; and (3) supporting farm work to prevent crop diseases and pests.

Taking these into consideration, we believe the practicality of the PaDB system has considerably improved.

In the future, we need to develop a database for actual crop protection cases, and propose the standards, by which we can effectively link all the relevant data from other fields to the PaDB system. The peer to peer network technology should be suitably used to build the database for actual crop protection cases, and the XML technology is suitable to set up these standards.

REFERENCES

[1] NTT DoCoMo Inc. (2001) All about i-mode INDEX, http://www.nttdocomo.com/i/

[2] NTT DoCoMo Inc. (2001) Outline of i-mode compatible HTML, http://www.nttdocomo.com/i/tag/imodetag.html

[3] T. Kouno (2001) Studies on Network Support Systems for Crop Growth Monitoring and Crop Protection. Thesis for a doctorate of Tokyo University of Agriculture and Technology.

[4] T. Kouno, M. Ayabe, H. Hitomi, T. Machida, S. Moriizumi (2000) Development of Relational System between Plant Pathology Database and Pesticide Database. Proc. of the 2nd Asian Conference for Information Technology in Agriculture. pp. 140-143.