

## A WEB BASED INTERACTIVE LEARNING PACKAGE FOR REMOTE SENSING EDUCATION

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### ABSTRACT:

A web based interactive learning package for remote sensing education RS-fun has been developed using Macromedia Flash program. The main purpose of the software package is to allow beginners to learn about the concept of remote sensing. The package consists of a series of sessions. In each session, the concept of one theme is explained with graphics and images. After reading the explanation, users have to answer to a kind of game type questions. The interactive operation of the software allows users to understand the concept of each theme step by step. Important key words are hyper linked to detailed information for further study. Finally the score will be displayed on the display for self-evaluation. The main concept of the software is development is "edutainment"; education and entertainment.

### 1. INTRODUCTION

Because of the earth environmental issues, importance of remote sensing education is expanding. Nowadays, various kinds of educational materials on remote sensing are on the Internet. Those materials can be categorized to three types. The first is textbook type materials with some images and/or tables. The second is power point/slide type materials. The third is lesson plans and useful information for teachers.

#### (1) Text type materials

"Remote Sensing Tutorial (RST)" of NASA/GSFC (<http://rst.gsfc.nasa.gov/>), "Fundamentals of Remote Sensing" of CCRS ([http://www.ccrs.nrcan.gc.ca/ccrs/learn/tutorials/fundam/fundam\\_e.html](http://www.ccrs.nrcan.gc.ca/ccrs/learn/tutorials/fundam/fundam_e.html)), and "Remote Sensing and Image Analysis" by Peng Gong at the University of California at Berkeley (<http://www.cnr.berkeley.edu/~gong/textbook/>) are good examples of the text book type materials. Not only the concept of remote sensing but also various applications are explained in details in these materials.

#### (2) Power point /slide type materials

Many universities are now providing power point type teaching materials through their web site to support their students, and some of them are open to public. For an example, The Department of Geomatics at The University of Melbourne (<http://www.geom.unimelb.edu.au/>) is providing many good lecture slides at their web site for the students to download.

#### (3) Lesson plan type materials

As for the lesson plan type materials, "From A Distance" web site of NASA (<http://education.ssc.nasa.gov/fad/default.asp>) would be a good example. This site is well prepared for the education of remote sensing, GIS, and GPS. Practical lesson plans for Grades K-3, 4-8, 9-12 are presented, and teacher approved web sites are listed.

However, many of those materials are prepared for university level students or teachers of lower grade schools. Good web based educational materials for introducing remote sensing to

high school or lower grade students are still limited. With the advancement of web technology such as JAVA or Macromedia Flash, it is becoming quite easy to introduce animation and interactive operation to the educational materials on the Internet. "Image Interpretation Quiz" web page of CCRS ([http://www.ccrs.nrcan.gc.ca/ccrs/learn/tutorials/iquiz/intro\\_e.html](http://www.ccrs.nrcan.gc.ca/ccrs/learn/tutorials/iquiz/intro_e.html)) is an good example of interactive educational materials of remote sensing on the Internet.

### 2. DEVELOPMENT CONCEPT

In the passed, authors have developed various software packages for remote sensing education (Cho 1988, Cho et al, 1994, 1997, 1999, 2000). Those software packages were quite effective for teaching remote sensing to the beginners of university level students. However, on the other hand, authors have recognized the importance of developing educational materials more focused on high school or lower grade students as well. In order to interest those students, the authors decided to introduce the concept of "edutainment"; education and entertainment for developing the software. The followings are the main concept of the educational software package "RS-fun" which we are developing in this study.

#### (1) Users

Beginners of remote sensing, including high school or lower grade students

#### (2) Purpose

To allow users to understand the basic concept of remote sensing with some fun

#### (3) Methodology

Q&A interactive operations with game type functions

#### (4) Authoring tool

Macromedia Flash

### 3. SYSTEM CONFIGURATION

RS-fun is a software package which runs on Windows PC with Internet connection and Flash player installed browsers. RS-fun mainly consists of Q&A module, jigsaw puzzle module and Database module.

#### 3.1 Q&A module

The Q&A module consists text type learning materials with various question and answer related to remote sensing. Each material explains certain concept related to remote sensing. After reading the learning material, user has to answer to some questions to check his/her understanding. By using the graphical/animated function of Macromedia Flash, the learning procedure with Q&A module becomes more like playing a game.

#### 3.2 Jigsaw puzzle module

The Jigsaw puzzle module contains a series of digital jigsaw puzzle consist of certain satellites image such as Landsat/TM, JERS-1/SAR, Terra/MODIS. The jigsaw puzzles are not only for fun but also give good chance for the beginners to look satellite images in details.

#### 3.3 Database module

Database module consists of various detailed information on remote sensing including remote sensing images. Important key words such as “electromagnetic wave”, “satellite”, “platform” in the Q&A module as well as in the jigsaw puzzle module are hyper linked to the database module, so the user can learn more details on certain subject.

### 4. OPERATION PROCEDURE

#### 4.1 Q&A module

##### (1) Understanding

At first, a user starts reading the text of the Q&A module. Fig. 1 shows a material explaining the concept of remote sensing.

##### (2) Q&A

Once the user has understood the idea, the user has to answer to some questions relating to the subject. Fig. 2(a) shows an example of those Questions. According to the user’s answer, the message “WRONG!” or “CORRECT!” would be displayed on the screen as shown on Fig. 2(b) and (c). If the answer was wrong, check mark is displayed on the screen, and the user can try again if he/her wanted. This kind of interactive operation does excite the user’s interest in answering the questions. The question starts from a e easy one and step up as the pages go on.

##### (3) Simplification

For understanding certain concept, simplification is quite useful. However, once the concept is understood, it is very important to learn more about the reality. In RS-fun, additional information on each subject will be provided from the Database module. Fig. 3 shows such an example. The spectral reflectance curve of color ball is simplified in the exercise (see Fig.3(a)). However, for further understanding, user can see the real reflectance curves of three different vegetations provided from the Database module (see Fig.3(b)).

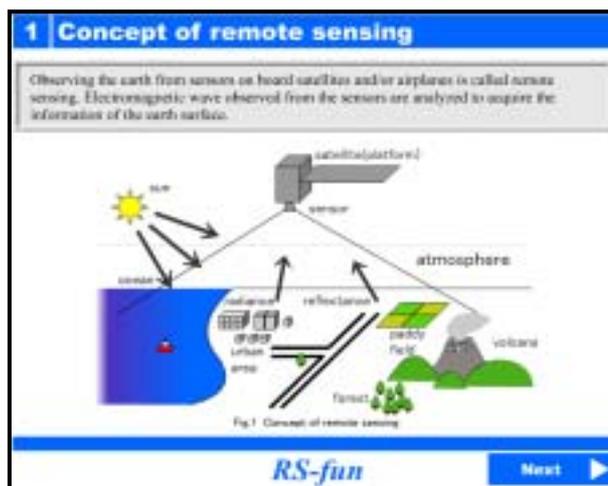
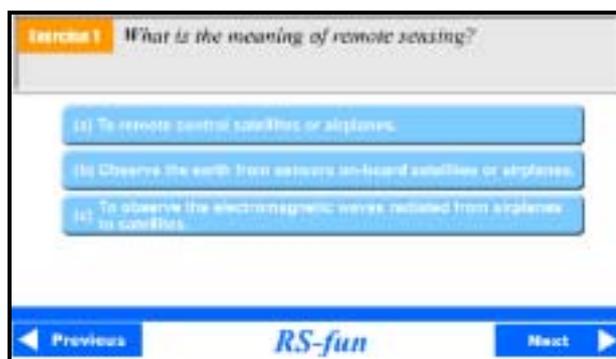
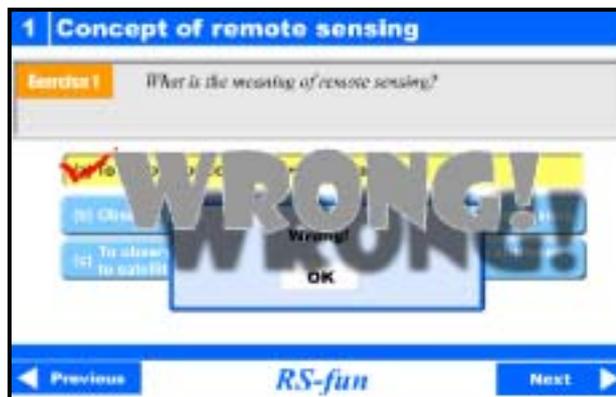


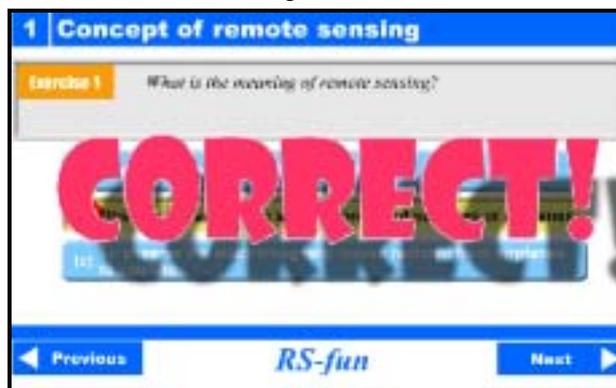
Figure 1. Example of the material of the teaching module



(a) Question

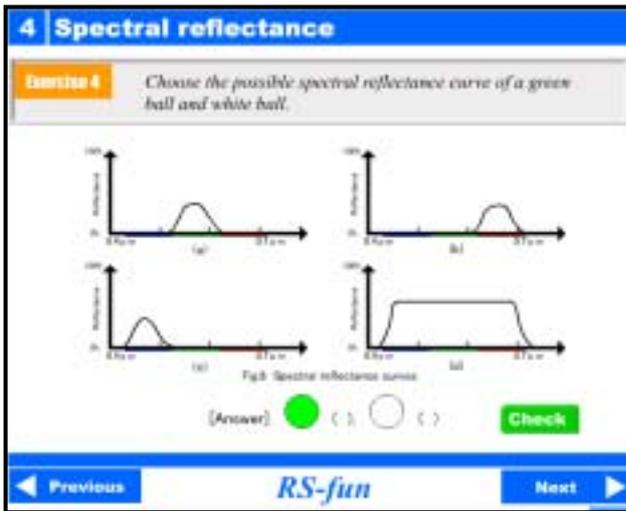


(b)Wrong answer

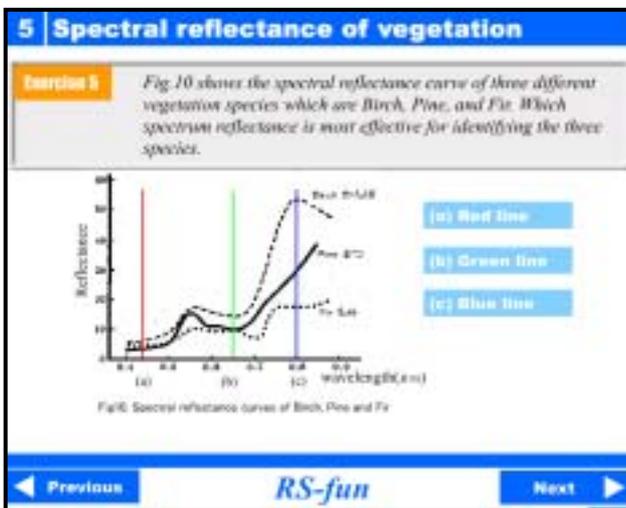


(c)Correct answer

Figure 2. Example of Q&A materials



(a) Simplify of spectral reflectance curve in exercise.



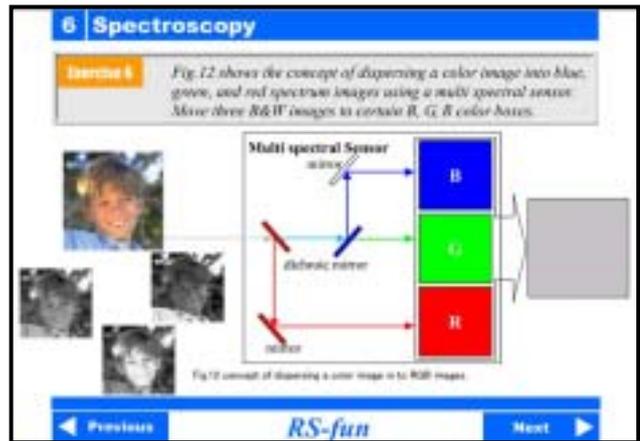
(b) Real spectral reflectance curves of Birch, Pine and Fir. Figure 3. Simplified and detailed information

**(4) Graphical Operation**

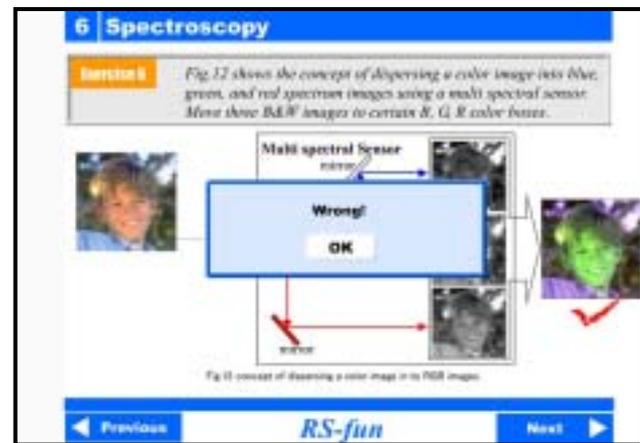
The Graphical operation is another important function of RS-fun. Fig. 4 shows one of those examples. The concept of spectroscopy and color composite are explained in this session. The user has to move the black & white images of a boy to certain color box (see Fig. 4(a)). If each image is not set in right order, the composite color image does not become same with the original image(see Fig. 4(b)). Because of the graphical operation, user are more likely to enjoy answering to each questions.

**(5) Score**

When the user comes to the end of the sessions, the total score of the user will be displayed as shown on Fig. 5. Like a game, the score will be a good motivation for trying RS-fun again for the further understanding of remote sensing.



(a) Question



(b) Answer

Fig 4. Graphical operation in Q&A



Figure 5. Total score of the exercise

**4.2 Jigsaw Puzzle Module**

Fig.6 show the procedure of how to “play” the satellite image jigsaw puzzle. When a user starts to “play” the puzzle, the satellite image (see Fig. 6(a)) is divided in to 5 x 5pieces and shuffled (see Fig. 6(b)). The user has to move each piece to

right place to re-construct the original image. By pushing the NAVI button, user can see the hint image in light colors (see Fig. 6(c)). The lapsed time will also be displayed in the bottom of the image. Since beginners such as high school students like to improve their time for completion, they try to recognize the detailed patterns of satellite images.

More over, when users click the name of the satellites and sensors, the detailed information will be displayed on the screen. These information help users to understand about the specifications of the satellite and the sensor of the image. In this way, RS-fun allows users to understand remote sensing with some fun.

Since the authors have prepared software to automatically produce jigsaw puzzle from digital images, increasing the number of the satellite image jigsaw puzzle is very easy. The authors are pleased to cooperate with others who are interested in contributing to this activity.

### 5. CONCLUSION

In order to allow beginners including high school or lower grade students to learn about remote sensing with some fun, educational software package RS-fun has been developed. In the Q&A module, the learning texts are quite easy to understand, and game type Q&A helps users to check his/her understanding of each subject. The Database module provides detailed information about the important keywords in remote sensing. After several integrations, the RS-fun will be accessible via Internet to any users. So far, the test version of RS-fun is accessible at the following site:

<http://www.yc.ycc.u-tokai.ac.jp/ns/cholab/RS-fun/index.html>.

The authors are pleased to cooperate with other educators who are interested in the integration and use of RS-fun.

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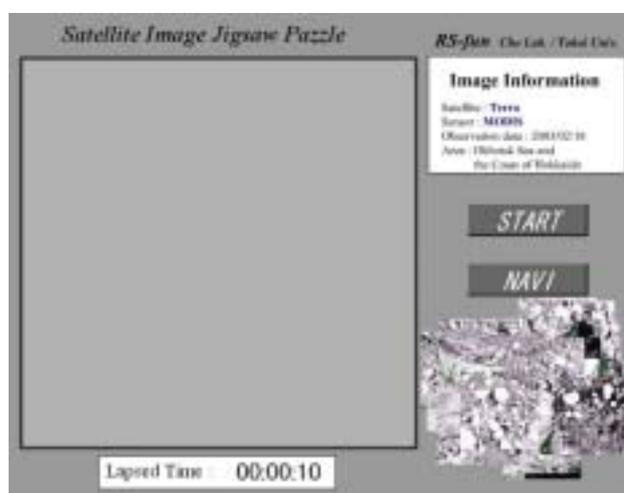
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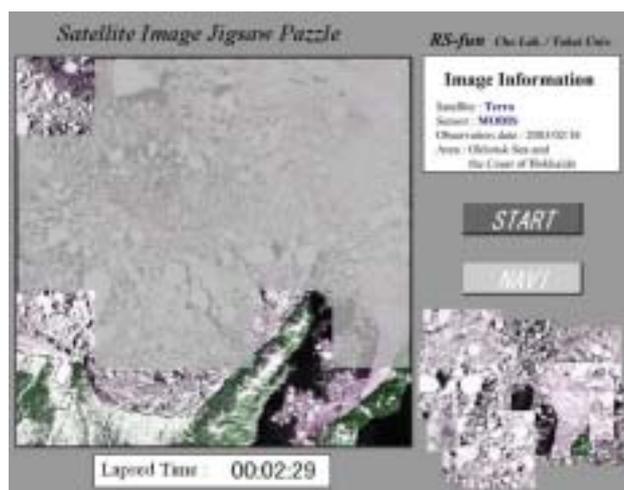
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(a) Initial layout



(b) Shuffled image pieces



(c) NAVI displays the hole image as a hint  
Figure 6. Remote sensing image jigsaw puzzle