Proposal of a map-making system for mobile learning that uses subjective geographic recognition

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Abstract

This paper describes a technique for mapping objects such as insects and plants in the field on a blank map in mobile learning. We propose map creating system that utilizes man's subjective geographic recognition in addition to a GPS. With the help of man's ability of recognizing placement of objects and geographical relations between objects, objective geographic information with small error given by a GPS is effectively compensated.

1. Introduction

Mobile devices such as mobile phones and mobile PCs have become popular tools. Research on location information that uses GPS devices has been paid a lot of attention recently [1][2].

This is also true in educational application. For example, observing various objects such as insects and plants outdoor and then making a map has been a popular learning activity in schools. Mobile phones and GPS devices have been introduced in this type of learning recently [3][4].

In this paper, we propose a map-making technique for this type of learning. Use of man's subjective geographic recognition in addition to latitude and longitude that are given by a GPS when mapping observed objects improves quality of a resulting map.

2. Subjective geographic information

Subjective geographic recognition is different from objective geographic information, i.e. latitude and longitude. It has a different form ("right of supermarket" and "under the apple tree", for example). It can be complementary information to the objective geographic information with unavoidable error.

Actually mapping objects only by objective geographic information from a GPS often results in overlapping of the objects or erroneous placement.

On the other hand, the subjective geographic information can be trustworthy when he/she is there in the place of mapping objects, and it can be used easily. The subjective geographic information cannot give absolute coordinates that a GPS can, but it can give relations between objects. This is considered to be helpful to make a map of objects. The subjective geographic information would be especially helpful when mapping objects in a small area because the error of a GPS data has more influence.

3. Prototype system

3.1. Overview of the system

Based on the consideration that is explained above, we have developed a prototype of map-making system for mobile learning. The appearance of the prototype system is shown in Figure 1. A GPS device is connected to a tablet PC. A tablet PC is considered to be better in mobile use for its pen-based input than a note PC.

What is seen in the display is a map-making application for mobile learning. When a user observes an object and would like to put the information on a blank map ("collect" the object), it can be done instantly right there. The user takes a picture of the object with a digital camera that is also connected to the tablet PC, and gets the location information of the object by the GPS. Then he/she can edit and arrange the collected object by the application.

3.2. Map-making application

The map-making application, which is built by Java, can display and organize collected objects on the map. The application has a contents-edit window (Figure 2)

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Figure 1. Appearance of the prototype system

and a map window (Figure 3).

In a contents-edit window, a picture of an object that is taken by a digital camera is displayed as well as the location information automatically given by the GPS. A user can add the subjective geographic information to the data.

The user can associate the object data with another object data that is stored in the system. He/she picks up an object from a listing of the stored objects and then selects relationship to the target object such as “right”, “left”, “upper”, and so forth. The mapping of the objects is based on these location data.

Because a map does not always contain enough objects to refer for a user, he/she can also add objects besides taking a picture. Take a flower found in a bush for example. The user wants to indicate the location of the flower in association with the bush, but it is likely he/she does not find it in the map. Then he/she can take a pen and add the bush in the map by the paint function of the application. Figure 3 shows a map with some “pictured” objects with icons and “painted” objects in freehand drawing.

4. Conclusion

In this paper, we propose and develop the map-making system that utilizes man’s subjective geographic recognition in addition to objective and absolute location information, namely latitude and longitude. The system helps users to associate contents on the map with their surroundings easily.

Moreover, information that is not on the map, such as "direction board" and "lawn", is important for the users. Our system can add such information on the map using paint function, also with latitude and longitude.

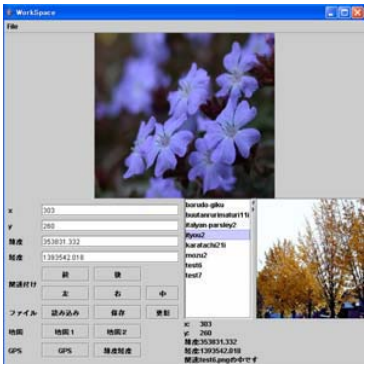

Figure 2. Contents edit window

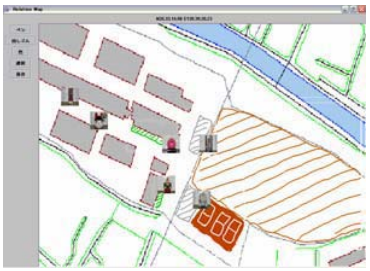

Figure 3. Map window

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