

Development and Evaluation of a Map Annotation System Using a Digital Pen

- An Example of a Distributional Survey of a Local Shopping Area -

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Introduction

□ (Background)

Recently, mobile devices are being used for fieldworks. However Sheets of paper are used widely for fieldworks even now.

□ (Problem)

For analyzing handwritten data on sheets of paper, users have to digitize the data by manual operation.

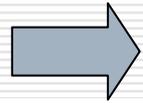
□ (Solution)

a map annotation system, GeoMemo

- collecting data by the paper-and-pen method
- translating from handwritten map annotations to digital geographic data efficiently.

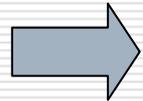
GeoMemo: A Map Annotation System Using a Digital Pen (System Requirements)

- [Preparation] An area and issues for the fieldwork are decided.



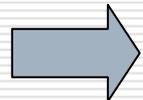
a map annotation form creation function

- [Gathering data in a field] Data concerning the issues are collected in the area.



a fieldworks with a digital pen and a map annotation form

- [Post processing] The data collected during the fieldwork are classified and analyzed.



translating function from handwritten map annotations recorded in the digital pen to digital geographic data

Demonstration

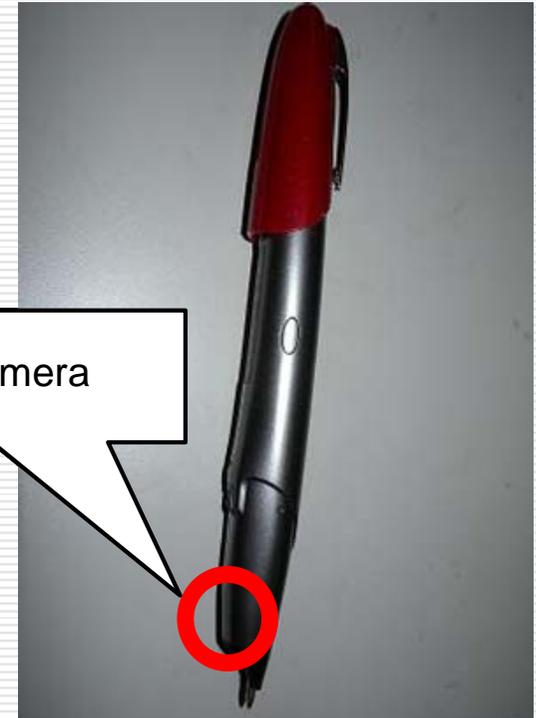


A digital pen

- GeoMemo uses a digital pen produced by Anoto Group AB
- Recording handwritten strokes by reading a special dot pattern printed on a piece of paper by a small digital camera embedded in the pen

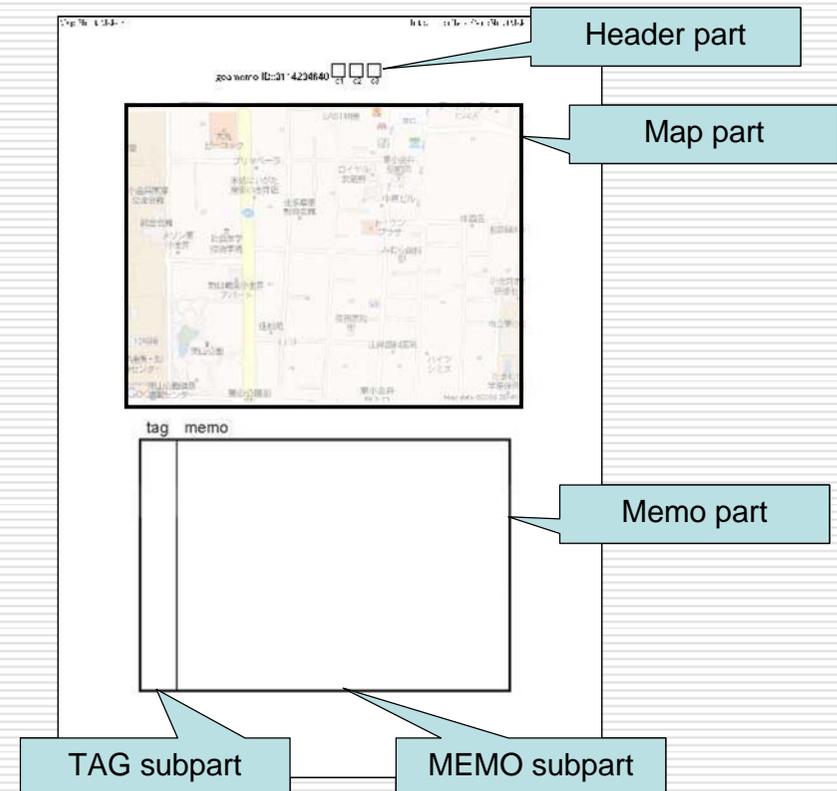


A digital camera

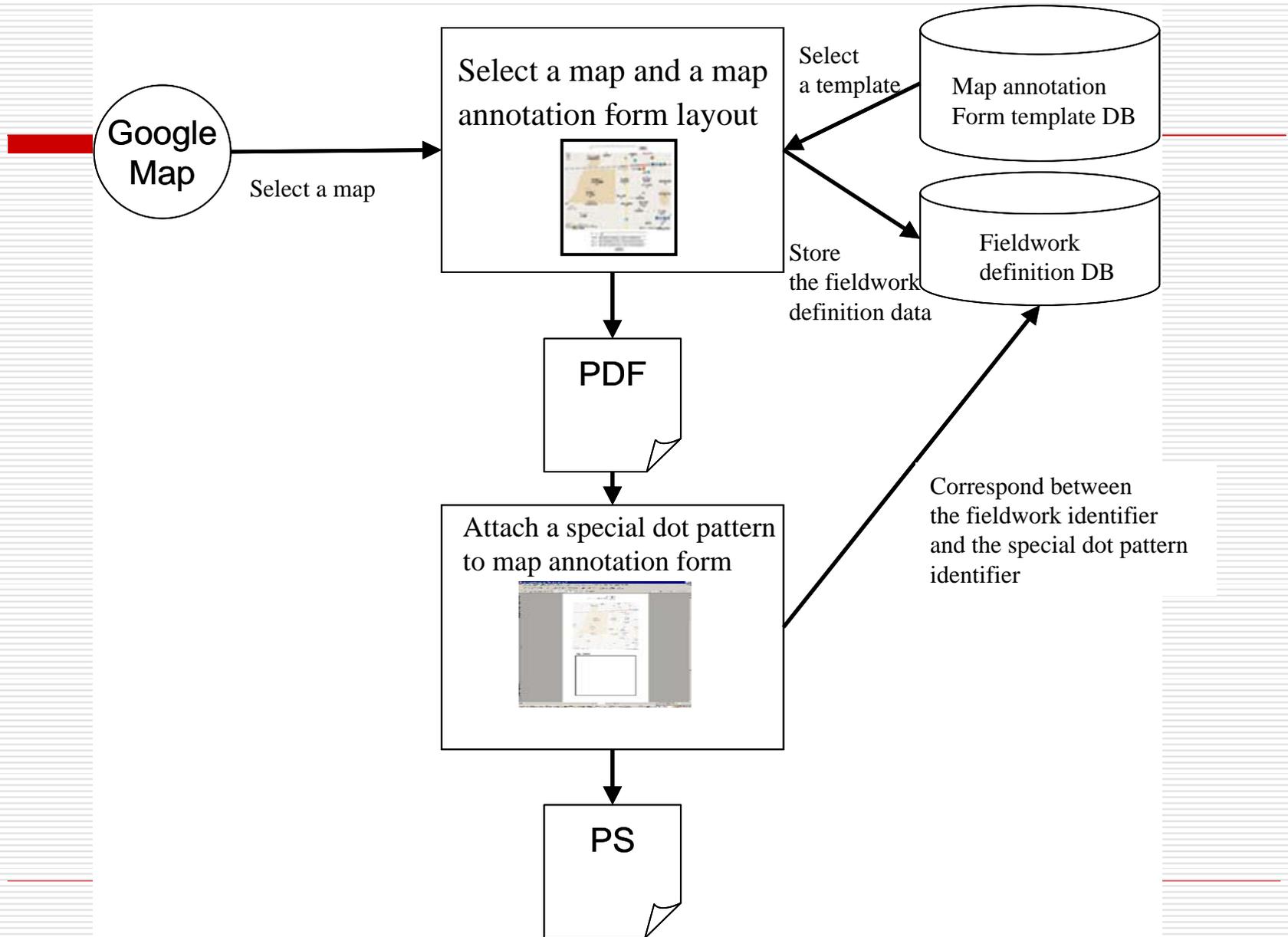


A Map Annotation Form

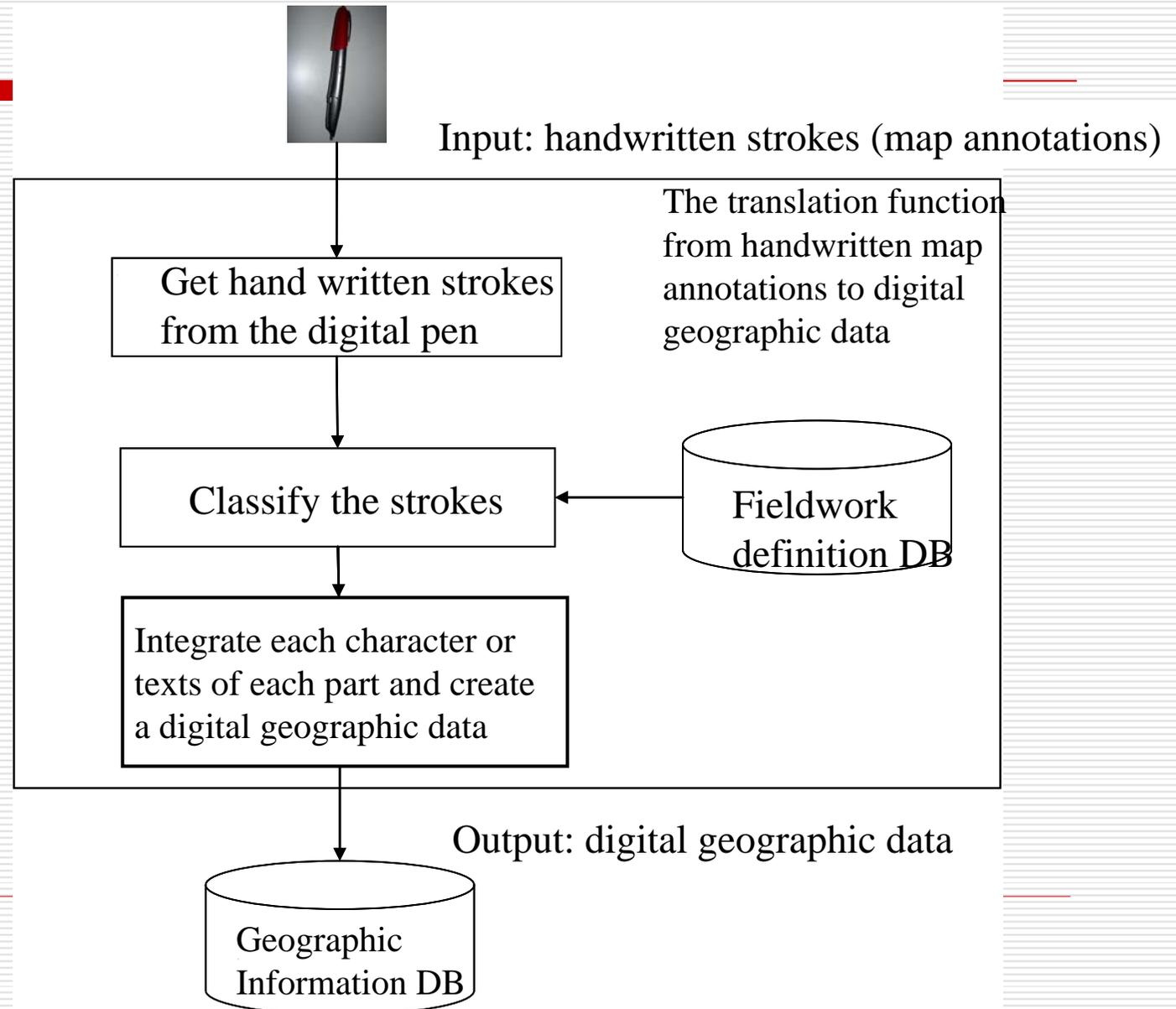
- Header part
This part shows a fieldwork identifier and command areas.
- Map part
This part shows a map for the fieldwork.
- Memo part
On this part, the user can write annotations related to the marks on the map part.



Creation function for map annotation forms



Translation function from handwritten map annotations to digital geographic data



Applications for GeoMemo

- 1. Survey based on map annotations**
users collect data by writing annotations on paper maps freely about something noticed by the users.
 - 2. Simple field distributional survey (simple survey)**
the users collect data abided by predefined items
 - 3. Advanced field distributional survey (advanced survey)**
the users collect data which consist of the related predefined items before fieldworks and the additional data on the fieldworks.
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Preliminary Experiment

□ Objective

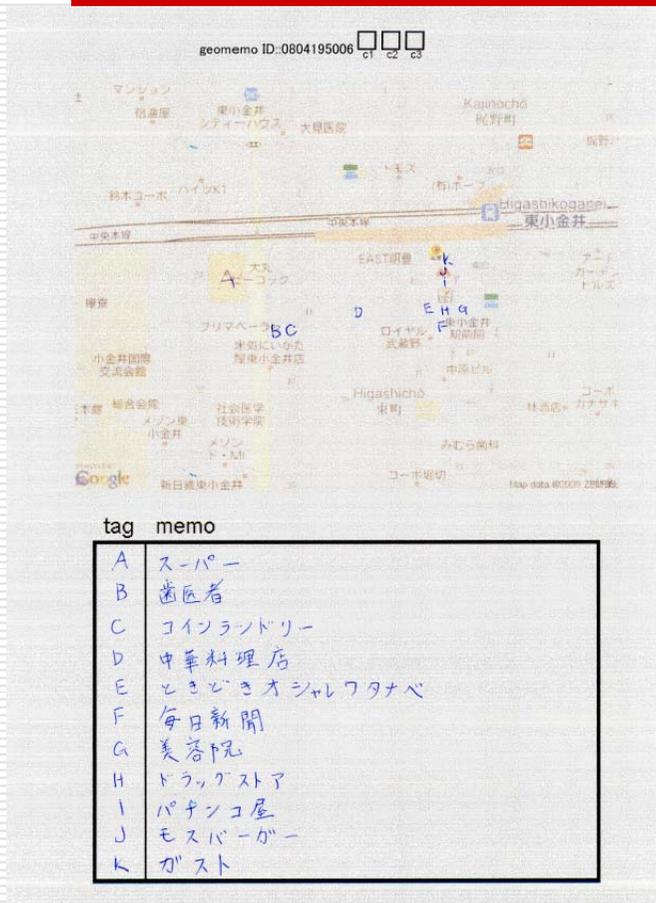
- (a) usability about creation of handwritten map annotations in fieldworks
- (b) efficiency about translation from the annotations to digital geographic data.

□ Subjects

9 undergraduate and graduate students

□ Procedure

1. We explain for the subjects about how to use the digital pens and how to make map annotations using map annotation forms.
2. Each subject carries out the fieldwork for his/her specific aim (survey based on map annotations or simple survey)
3. The subjects try to translate their collecting handwritten map annotations to digital geographic data.
4. The subjects answer a questionnaire and give free comments



Since the digital geographic data correspond exactly to the handwritten map annotations, effectiveness of the translation function is verified.

Result

Questions	Average
Was it easy to specify the positions using a paper map in the map annotation form?	2.78
Was it easy to make a map annotation using the form?	3.44
Did you concentrate the fieldwork?	3.22
Was it easy to translate the handwritten map annotations to the digital geographic data?	2.67
Is there any issue about the results of the character recognitions?	2.29
Is there any issue for displaying the geographic data on the GE?	2.00

From the results of the questionnaire, using the digital pens and map annotation forms in fieldworks was highly evaluated by the subjects. On the other hand, evaluation of translation function from the annotations to digital geographic data was low.

Discussion

- GeoMemo can support users to collect geographic information about objects at distance location in fieldworks without GPS.
 - GeoMemo to introduce new rules to divide the sequence of the handwritten characters into the each character when the users write marks on the map part of a map annotation forms.
 - GeoMemo should be prepare the following functions:
 - (1) the digital pen can record the edit operations of handwritten texts and the writing operations of figures on map annotation forms by pointing special parts on the forms
 - (2) GeoMemo edits the digital geographic data.
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Conclusions and future works

- GeoMemo
 - Users can collect map annotations based on an environment which is similar to paper maps and a pen in fieldworks.
 - Users can translate the handwritten annotations on the map are digitized to geographic data efficiently.
- The result of a preliminary experiment
 - GeoMemo is recognized to be useful for collecting map annotations in fieldworks. However, the system has to be improved with respect to the interface for checking results of character recognition.
- Future works
 - Improve the interface for checking the results of the character recognition and add the command functions to GeoMemo.

Thank you.
