
A Mobile Phone-Based Exploratory Citizen Sensing Environment

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Abstract

Coping with ill-structured problems in a city involves continuous, opportunistic, and multi-perspective processes, which existing pervasive technologies for citizen participation cannot easily support. Based on two preliminary case studies, we propose Scene Memo, a mobile phone-based exploratory citizen-sensing environment that uses dynamically shared tags to provide social cues and scaffold participants.

Author Keywords

Civic engagement; citizen sensing; social search

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

Citizen participation plays a key role in the design of the spaces they inhabit, as well as the design of the solutions to the problems they face. The ubiquity of smartphones enables various kinds of technology-enhanced methods for citizen participation, including participatory sensing[1], citizen science[2], and geocentric crowdsourcing[3]. They seem to be on the verge of making a significant impact in the real world, as people increasingly use pervasive technologies to

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share information about local problems[4], geo-tagged radiation Geiger counter readings[5], and so on.

A key limitation to these existing technologies for citizen participation is the relative lack of the support for exploratory data collection. This limitation could trivialize the impact of pervasive technologies in urban spaces since many of the real-world, societal problems in a city can be considered ill-structured, 'wicked' problems[6] that one cannot simply "first understand, then solve." Coping with such problems can require a more open-ended, exploratory data collection environment based on *situated actions*[7], which considers different perspectives of participants and supports continuous and opportunistic processes.

Based on two preliminary case studies, we propose Scene Memo, a mobile phone-based exploratory citizen-sensing environment that uses dynamically shared tags to provide social cues and scaffold participants. Research shows that a tag-based exploratory system enables rapid exploration, and possibly provides a kind of scaffolding for learning in Web search[8] [9]. We extend and integrate such tag-based approach in a participatory citizen-sensing environment to support civic exploration in physical and digital spaces.

Existing Practices

The following preliminary case studies are revealing of the importance of collaborative and exploratory practices in citizen-centered data collection activities.

Citizen Sensing after a Nuclear Disaster

The recent nuclear disaster in Fukushima caused fears and concerns of radiation hotspots in some Japanese

cities, including the city of Kashiwa in Chiba. A grassroots organization collected radiation data at more than thirty parks in Kashiwa during the period between November 2011 and December 2012, using radiation sensors (Mr.Gamma A2700¹).

A close look at their fieldwork in February 2012 allowed us to understand the teamwork practices that had been shaped since the beginning of this collective endeavor. A team of three participants includes a *measurer* who operates an A2700, a *recorder* who records measurements and locations on a piece of paper, and an *explorer* who explores the 'suspicious' spots to determine the exact points that must be measured. Participants are opportunistic and adapt their work to different situations in the field, and the teams share their results and insights during lunchtime before embarking on afternoon fieldwork. These collaborative work practices provide a learning opportunity for novice participants, who eventually become more skillful in finding radiation hotspots.

Participatory Fieldwork in Suburban Tokyo

A community fieldwork event that took place in suburban Tokyo aims at discovering and mapping attractive elements in the town, using maps and digital cameras. Four or five participants worked together in each team taking photographs, jotting down their findings and ideas, and recording the relevant location information.

¹ <http://www2.clearpulse.co.jp/indexEng.html>

The fieldwork is embedded in a three-step process: (1) a planning session to discuss and agree on the kind of information the team wants to collect, (2) the fieldwork itself, and (3) a post-hoc discussion and map-making session. A facilitator and a graphic designer help the teams in step 1 and 3, respectively. Overall, it is more open-ended and exploratory than the first case, and characterized by the diversity of perspectives and expertise.

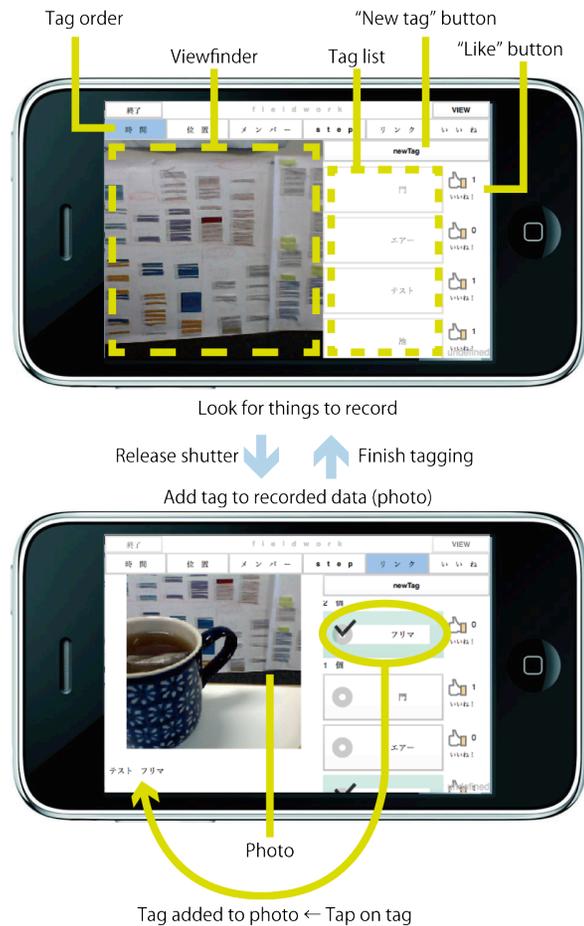


Figure 1. User Interface of Scene Memo.

The Scene Memo System

We designed and developed the Scene Memo system to support exploratory citizen sensing in teams. In particular, we consider the three-step procedure that is illustrated in the second case study, and use shared tags to support exploratory social search in the field.

As shown in Figure 1, users can take pictures and add tags to the pictures easily on a smartphone or a tablet PC. Users can either create a new tag by using the “New tag” button or reuse existing tags in the Tag list.

The system immediately uploads the pictures and the tags to a shared server, along with a timestamp, location information and a user name. Moreover, users can push a “Like” button to increase the score of the corresponding tag, which is also uploaded to the server.

The tags can be ordered according to different criteria, including the time and location at which they are created, the names of their creators, the numbers of pictures they are associated to, and their “Like” scores.

This user interface can be used in the planning session (Step 1) and the fieldwork (Step 2). The collected data are displayed and manipulated on a tabletop device in the post-hoc discussion and map-making session (Step 3).

The system supports three types of tag sharing (i.e., T1, T2, and T3), which allows for flexible integration of Scene Memo into the sociotechnical setting of the overall fieldwork procedure:

T1: Fieldworkers use a fixed set of tags that someone (e.g., a domain expert) prepares in advance.

T2: Fieldworkers can create, modify and delete tags *in situ*, and use them personally.

T3: Fieldworkers can create, modify and delete tags *in situ*, and share them with other fieldworkers.

In August 2012 and November 2012, we recruited 12 and 15 participants, respectively, and asked them to use Scene Memo and collect fieldwork data in teams, in a park and three university campuses, under different conditions. Most importantly, our experiment has shown that the capability of Scene Memo to create and share tags *in situ* provides social cues that affect exploratory data collection in different ways. Participants used these social cues to work efficiently by avoiding redundancy, socialize and compete with other participants. Also, it seems that shared tags can

support a type of discovery and learning when it is embedded in a right kind of sociotechnical environment and collaboration context. This is in line with what existing research shows about exploratory Web search[9].

Compared to an existing tag-based exploratory system[9], Scene Memo exploits more real-world information, such as location data, to support the process to seek useful tags that fit the collected pictures.

Conclusion and Future Work

Our case studies reinforce the argument that citizen-sensing environments must support exploratory data collection. Scene Memo is a citizen-sensing environment that is designed for exploration and uses dynamically shared tags to provide social cues in a fieldwork.

One of the limitations to the current version of Scene Memo is the unproven scalability in terms of the number of tags as well as the number of participants. Scalable support mechanisms could be designed for different kinds of exploratory tasks. Our future work includes a study in an authentic fieldwork environment as well as an extension to support sensemaking[10] in citizen sensing to enable rapid and meaningful exploration in the field.

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