SOCIAL MEDIA AND SENSORS FOR CITIZENS ENGAGEMENT AND COOPERATIVE SITUATION AWARENESS

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Keywords

Citizen observatories, Situation Awareness, Social media, Social Sensors, Crisis Management

Abstract

Citizen observatories are increasingly popular as means to establish interaction and co-participation between citizens and authorities. WeSenseIt is an EU FP7 project that aims at developing citizen observatories of water and flooding, which will allow citizens and communities to take on a new role in the information chain: a shift from the traditional one-way communication paradigm towards a two-way communication model in which citizens become active stakeholders in creating Situation Awareness.
WeSenseIt will leverage different levels of participation based on Social Media and physical sensors using custom mobile and web applications integrated with existing social media platforms.

A combination of crowdsourcing and custom applications will be adopted to empower and foster participation with the objective of creating an enriched knowledge base to foster decision making during emergencies while creating the basis for collaboration, trust and accountability of actions.

To collect data and observation from stakeholders, WeSenseIt is developing two different applications:

1) Social Media Analysis Tool: A platform to gather, store and browse data shared on existing social media platforms (e.g. Facebook, Twitter, Flickr). This platform is able to gather social media data in real-time given keywords or hashtags as input. The retrieved data is then stored and processed using Natural Language Processing techniques and presented to the users using multiple visualisation widgets to facilitate the navigation of the very large information space.

2) Citizens Observatory Mobile App: A custom mobile app that interacts with existing social media platform (using Facebook API) to provide a familiar interface for users to submit and receive alerts, information and dialogue with other users and/or authorities. The app provides functionalities for physical Sensor readings, where users can scan a QR code to upload directly the reading of a sensor and for interactive flood planning.

Introduction

A key success factor is to achieve and maintain situation awareness, i.e. “accurate, complete and real-time information about an incident” [Winerman, 2009], to understand “the current local and global situation and how this may evolve over time” [Endsley, 1995]. Traditional approaches to situation awareness and crisis management tend to rely on official communication channels, which are generally slow in providing information, due to the need of releasing only information that has been verified and approved. However, information spreads very quickly by word of mouth, especially on social networks (e.g. Facebook and Twitter). The sole reliance on formal communication channels, as both the source of information and a way to communicate with the citizens, is becoming increasingly ineffective. On the one hand, the traditional methods promote a passive role for the community, i.e. citizens are traditionally considered target of enquiry and in general at the very end of the information chain, rather than partners in situation awareness. On the other hand, citizens tend to focus on the abundance of up-to-date (although often unreliable) information on social networks rather than on the scarce and potentially out-of-date official information [Sutton, 2008]. In this sense, social networks have already changed the information landscape and have become a major source of information for authorities, organisations, individuals and groups [Kwak, 2010]. Social media are used as: news sources (making possible for people and organisations to get real-time news and information about an event or a topic [Teevan, 2011]) and news channels (by individuals, groups and organisations to spread information, as well as ideas, etc.). They support self-organising behaviour that can provide accurate information often in advance of (and sometimes alternative to) official communication [Vieweg, 2010]. In this sense, social media offer an excellent opportunity for situation awareness and crisis management; they often give a timely picture of events, allowing for both early warning of incidents as well as means for early situation awareness, even before police or rescue personnel arrive on the scene. Additionally, information from social news media does not only provide facts about the physical situation, but allows the possibility to assess the state of mind of people involved, e.g. positive and negative feelings, misconceptions etc. The immense volume of real-time, user-generated content collected from social media platforms or sources has already shown serious potential in applications such as disaster detection [Sakaki, 2010], seasonal mood level changes [Bollen, 2011b], tracking influenza rates [Lampos, 2010], box-office revenue forecast [Asur, 2009], political elections [Balasubramanyan, 2010], stock market prediction [Zhang, 2011], etc. Social media have also been shown to be key to social unrest management. For example, during the 2011 Arab Spring, the vast majority of people got their information from social media sites (88% in Egypt and 94% in Tunisia); for this reason, Facebook usage swelled in the Arab region between January and April: the number of users jumped by 30% to 27.7m, compared with 18% growth during the same period in 2010 [Storck, 2011]. #Egypt was the most popular hashtag on Twitter in 2011. The inability to understand the use of social media for protest organisation was key to the authorities’ inability to cope with the situation. Elsewhere instead, authorities increasingly use social media for monitoring events and crowds as well, during social emergencies and natural disasters [Slagh, 2011].

In this context, citizen observatories are emerging as means to establish interaction and co-participation between citizens and authorities both during emergencies but also during the day-to-day management of fundamental resources.
WeSenseIt is an EU FP7 project that aims at developing citizen observatories of water and flooding, which will allow citizens and communities to take on a new role in the information chain: a shift from the traditional one-way communication paradigm towards a two-way communication model in which citizens become active stakeholders in information capturing, evaluation and communication.

In a Citizens Observatory, all parties are active participants - creating knowledge about the situation in a participatory manner and contributing to dealing with the situation. In the Observatory, citizens will be encouraged to provide information to authorities and to other citizens; this in turn requires that authorities and organisations can comprehend the

information which is provided by citizens and provide information in a form which is best suited for citizen consumption.

To establish and maintain co-participation, it is fundamental to provide means to

i) Engage citizens in directly interacting with authorities and other stakeholders;
ii) Provide services for viewing, requesting and feeding back information.

The purpose of this paper is twofold. First, it presents the user studies carried out to identify and engage different stakeholders. Secondly it presents the technologies that will support their involvement. A combination of crowdsourcing and custom applications will be adopted to empower and foster participation with the objective of creating an enriched knowledge base to foster decision making while creating the basis for collaboration, trust and accountability of actions.

State of the Art

The proliferation of Web 2.0 services and web applications have introduced new opportunities for citizen co-participation in knowledge creation. Google Earth is possibly one of the best-known examples of the way citizens and organisations can collaborate to enrich geographical information [Goodchild, 2007]. Similar widely used services that build on the knowledge of citizens are Wikimapia, Flickr, Openstreetmap, and so on. While such efforts can produce large-scale knowledge, the full potential of citizens is better realized when their opinions, views and concerns are highlighted and shared with authorities and vice versa in a collaborative and seamless manner. An example from the environmental world highlights how existing data sources can provide large amounts of data, however, the way a condition can affect users can only be understood is by qualitative evaluations from citizens [Foerster, 2011]. Several tools and applications have been developed over the recent years to understand how crowdsourcing, citizen sensing and sensor technologies can be applied for health surveillance and crisis management. [Boulos, 2011] provides a survey of several such tools and application areas. A number of EU FP7 projects, in which present project members are engaged, have contributed to building a wide range of platforms for citizens-based data collection and sharing, e.g. WeKnowIt1. WeKnowIt investigated the use of collective intelligence with a specific case study in Emergency Response. Other projects that emphasise the need for citizens participation are COBWEB2, aimed at studying crowdsourcing techniques for collecting environmental data and CITI-SENSE3, aimed at developing citizen's observatories to raise environmental awareness among citizens and understand how their participation influences environmental decisions. While existing tools and technologies can enable citizens to collaborate with authorities, it is important to investigate how such methods can be included in decision making processes, whilst respecting the privacy and ethical concerns of citizens.

Theory and Method

In order to harness environmental data and knowledge to effectively and efficiently manage water resources, the WeSenseIt project will develop citizen observatories of water. These will be tested and validated in three case studies in collaboration with water management and civil protection agencies in the UK, the Netherlands and Italy.
A common methodology has been implemented in the case studies, taking into account cultural, organisational and practical differences. The methodology implemented has been

[1] www.weknowit.eu
2 http://edina.ac.uk/projects/COBWEB_summary.html
3 citi-sense.nilu.no/

tailored to fit both the project research plan and timeframe and the specific case studies requirements. The approach has been as follows:

1. The case study details, location, scope and purpose have been clarified with the end user partners. As part of the case study definition, we established working groups with involved stakeholders in each case study.
2. Suitable locations for each case study have been identified in cooperation with the case study partners.
3. Stakeholders identification and analysis have been carried out.
4. User requirements for both communities were elicited using user centered design techniques, adapted for each different scenario. The requirement analysis was twofold: on one hand we focused on eliciting requirements from professional users in all the three case studies, and on the other we scheduled meetings with citizens and interested exiting communities (when available) to gather the non-professional requirements. We used focus groups, interviews, questionnaires and low-fidelity prototypes to elicit requirements according to the specific users available for each case study. These activities resulted in a set of technical requirements for citizens observatories.
5. User requirements and scenarios drawn from the user requirements have and will be used to design the methodologies/tools/applications that implement the citizens observatory in the case studies.
6. Evaluations are planned at regular intervals, matching the development process to ensure the development process can mostly benefit from user studies findings.
7. The outcome of user requirements analysis and evaluations will be fed back to the development phase.
8. Stakeholders will be supported throughout the process, to guarantee they can make use of the new methodologies and technologies in an efficient and satisfying manner.

User Studies for Stakeholders Identification and Engagement

WeSenseIt has adopted a proactive approach to stakeholder engagement based on firstly identifying the stakeholders that are relevant for the Citizens Observatories and then gaining their support through a specific stakeholder analysis strategy that is aimed at gathering requirements for supporting participation.

The identification of stakeholders follows a methodology already proven in the management of UK environmental projects. Simple steps facilitate the building of a comprehensive list of stakeholders by directing their identification under different headings eg: different sector types then by their responsibilities then by their relationship to the risk and so on. This list of stakeholders can then be refined based on the stakeholders' importance to, interest in and affect by the development and maintenance of the observatory.
Stakeholders were then engaged using a user-centrered methodology to help clarifying:

- Who the users are
- What are the issues faced
- How are decisions made currently
- What are the barriers to what they consider effective action
- Which are the available data
- What is the environment
- Which are the main tasks
- Which are the information needs

From this understanding a strategy evolves based on the stakeholders' perspectives on engagement in the observatory and not purely on the aspirations of the observatory developers. The strategy is underpinned by a continual discourse of meetings, conversations and questionnaire surveys building empathy, trust and understanding of all the requirements of both stakeholders and observatory developers.

The WeSenseIt Technologies

Based on the outcome of the stakeholder engagement sessions, WeSenseIt is developing a series of applications to enable two-way communication channels between citizens and authorities, coupling involvement of citizens in the provision of data with the ability of authorities to communicate and feed back relevant information to them and encourage active involvement. To collect data and observation from stakeholders we are currently developing two different applications, to maximize the number of communication channels available for both sending and receiving information.

Social Media Analysis Tool: A platform to gather, store and browse data shared on existing social media platforms (e.g. Facebook, Twitter, Flickr). This platform is able to gather social media data in real-time given keywords or hashtags as input. The retrieved data is then stored and processed and presented to the users using multiple visualisation widgets to facilitate the navigation of the very large-scale information space.

Figure 1 - Social Media Analysis Interface

Citizens Observatory Mobile App: A custom mobile app that interacts with an existing social media platform to provide a familiar interface for users to submit and receive information. The mobile app is the core of the Citizens Observatories vision, as it provides citizens and authorities with a real-time data and observations aggregator that uses the data to provide additional services to all stakeholders.
The mobile app contains several functionalities to facilitate co-participation:

- Direct discussions, where users can view and/or contribute to geo-located discussions using familiar interface widgets, i.e. "Like" button, comments. Users can submit evidence in the form of photos or videos or sensor readings for any discussion.
- Requests for information, where authorities (or citizens) can communicate crowdsourcing tasks to citizens and staff members on the ground
- Alert features, provided by other users and/or authorities and emergency services containing important updates on an evolving situation

- Report submissions, where users can submit situation reports (e.g. flooding, accidents, emergencies, etc.) and attach multimedia evidence (photos, videos)
- Manual sensor readings, where users can scan the QR code of a sensor (e.g. water meter pole, rain gauge, etc.) to identify the sensor and send the reading directly to the authorities to improve situation awareness
- Interactive flood plan checklists, where citizens can browse flood checklists and tick every completed action. This serves as a useful tool for citizens to keep track of their actions during chaotic moments but also as a real-time notification tool for the authorities.

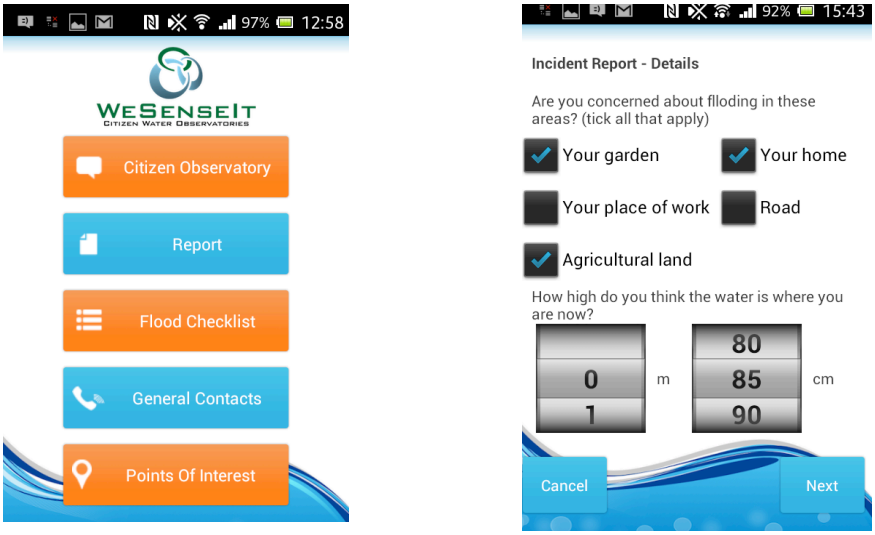

Figure 2 – Citizens Observatory mobile App – main screen (left) and sensor report (right)

Decision Support Web Application: A web application that allows authorities to easily visualise the data, ask questions and gain insight to support decisions made in emergency scenarios.

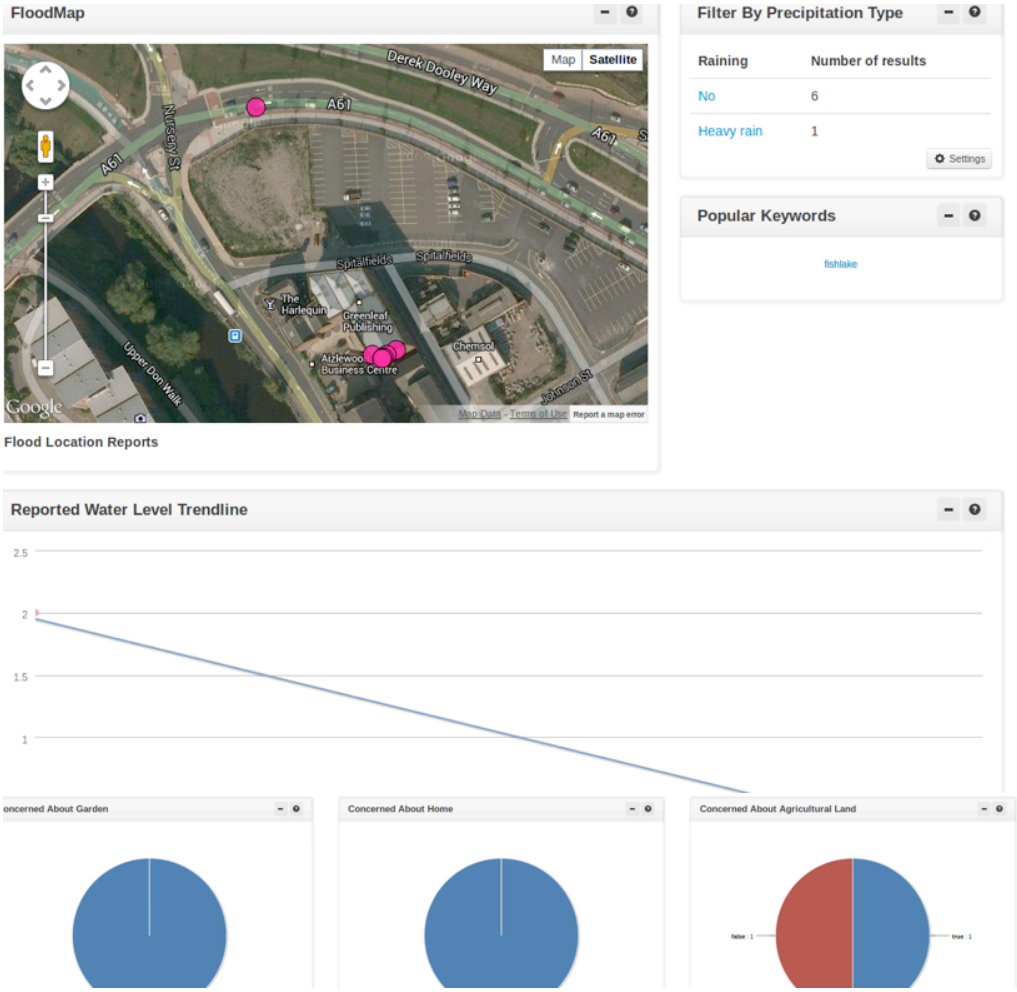

Figure 3 –Decision Support Web Application – main interface

Discussion

The key aspect of WeSenseIt is the direct involvement of users and communities in the environmental data collection and sharing process: it enables citizen involvement by collecting data via an innovative combination of easy-to-use sensors and monitoring technologies as well as harnessing citizens' collective intelligence, i.e. the information, experience and knowledge embodied within individuals and communities.
In order to keep the connections with the stakeholders alive and productive WeSenseIt will evaluate the developed technologies through the project lifetime, to encourage participation and involvement and to ensure any feedback from stakeholders could be incorporated as early as possible in the provided technology. The evaluations will be carried out in the form of a series of short-term evaluations, either lab or field based, and a a long-term field evaluation in all case studies.

References

References should follow the Harvard referencing format as set out in the 'Instructions for Authors'

Acknowledgements

This research was funded by the European Union Seventh Framework Programme FP7/2007-2013 under grant agreement n° 308429. www.wesenseit.eu.

Author Biography

Dr. Vitaveska Lanfranchi is a Senior Research Fellow in the OAK Group. Her research field concerns Human Computer Interaction with a focus on supporting, gathering and sharing of knowledge between individuals. She has an extensive experience in coordinating projects and designing, developing and evaluating systems with extensive users involvement. Vita has long experience in working and managing European projects for the University of Sheffield: among them: The European Integrated project X-Media, the TRIDS project on Tracking Real Time Intelligence in social media. She is currently managing Randms, a project on mining, gathering and visualising social media data for Emergency Response and is the Scientific Deputy Director for co-participation of WeSenseIt, a EU FP7 project on Citizens Observatories of Water. Dr. Lanfranchi holds a PhD and a Doctorship from the University of Torino, Italy.