How to make sense of citizen participation in environmental monitoring?

Cristina Gouveia (cgouveia@alum.mit.edu)
YDreams, Portugal

Introduction

Volunteer monitoring is not a new idea. Examples can be found applied to a large diversity of themes (from bird watching to surveying shorelines) and with different characteristics (from individual and *ad hoc* activities to highly structured initiatives organized by NGO or official entities).

The review of volunteer initiatives suggests that, overall, it is positive to involve citizens in environmental monitoring. Furthermore, the developments observed in areas such as public participation models, environmental sensing, and ICT may contribute to increase the impact of citizen initiatives. Although citizen participation in environmental monitoring is gaining increased support, no holistic view has been performed. By the contrary, most examples found represent isolated efforts and do not promote data reuse. A framework that addresses the drawbacks of involving citizen in environmental monitoring and, at the same time, explores the opportunities created by the social and technological developments, is needed. The creation of such framework requires addressing the following questions:

- How to equip citizens so they become more credible data producers? Are sensory data enough? How citizens may use sensors, particularly sensor networks?
- How to explore ICT to increase citizen participation? How to use ICT to facilitate data access and reuse? How ICT may facilitate the creation of communities of interest?

The Use of Human Senses to Collected Environmental Monitoring Data

Two case studies illustrate the use of human sensory data as a source of information for environmental monitoring: 1) chlorine flavors in tap water and 2) odors of paper pulp mil emissions. The results obtained in the two case studies confirmed that the diversity and subjectivity of human sensory data made them a difficult source of information for environmental monitoring. Indeed, the results of the tests suggested that sensory data by themselves are not enough for collaborative monitoring as they are not reliable and accurate. However, sensory data should not be ignored as in general such data provide a big picture similar to traditional monitoring measurements.

A Framework to Explore ICT to Support Public Participation

The proposal of a framework that explores the use of ICT to promote citizen participation in environmental monitoring comprises four major steps: 1) Analyze the issues involved in volunteer monitoring namely citizen tasks and motivations; 2) Propose two types of networks – Mobile and Fixed - to explore the potential of innovative ICT tools; 3) Evaluate the economical feasibility of implementing a framework and 4) Reflect on the requirements of ICT tools to be used.

The analysis of the issues involved in the creation of framework to support public participation was based on the open source model. By combining the open source model with the issues addressed by traditional monitoring networks, the framework takes advantage of the new means of organizing labor and knowledge applied to the context of environmental monitoring. The opportunities of ICT to support citizen participation were organized considering three building blocks: 1) Motivated Citizens; 2) Sensing Devices; and 3) A Back-end Information Infrastructure.

Conclusions

The creation of a framework that explore the use of ICT contributes to promote citizen participation in environmental monitoring by supporting citizen activities, such as data collection and communication, and by increasing the impact of citizen initiatives. Furthermore, the work presented in this paper allows to conclude the following:

- Human sensory data in a participatory context are not reliable to monitor environmental quality variables. However, sensory data should not be ignored because, in general, they provide a big picture similar to traditional monitoring measurements. Furthermore, sensory data, due to their characteristics, can be used to engage citizens.

- ICT provide tools to overcome the limitations presented by human sensory data. Indeed, the results of the case studies suggested that is more interesting to provide citizens with tools to increase data credibility than to find a quantitative relationship between human sensory data and traditional measurements.

- The diverse characteristics of citizen initiatives (from individual complaints to formal data collection initiatives) and the diversity of tasks involved (from data collection to advocacy activities) require a framework that uses a multiplicity of tools (from sensors to collaborative systems).

- Likewise to traditional environmental monitoring networks volunteer initiatives may benefit from the existence of fixed and mobile networks. Mobile networks are not constrained by predetermined location and are good to collect personal exposure data and outdoors variables. Fixed networks are good at creating temporal data series and have less constraints related to the equipment needed.
- The use of ICT allows collecting and registering non-traditional data types: from sensory data to personal exposure data. These non-traditional data types may present new opportunities for citizen participation in environmental monitoring because they represent more detailed and richer data. Additionally, the possibility to register multi-sensory data (for example through videos) may facilitate data validation and the engagement of citizens in environmental protection.

As a final point, the use of ICT to promote citizen participation in environmental monitoring may create opportunities in the education domain. Citizen education and awareness on environmental issues is one of the intangible benefits created by citizen participation in environmental monitoring. However, more research is needed on how to engage citizens in general and students in particular in learning activities. The following issues should be addressed 1) Explore the ICT tools to support educational activities in the field of environmental education and awareness. 2) Evaluate the potential of the framework to contribute to create more engaging educational contexts. 3) Proposal of activities to be developed within the framework targeting the community of students and teachers. The use of sensory data in a collaborative context to engage students in learning activities is being proposed by the Schoolsenses@Internet project (Marcelino, et al., 2007).

References

Marcelino, M. J., Gomes, C. A., Silva, M. J., Gouveia, C., Fonseca, A., Pestana, B., & Brigas C. (2007). SchoolSenses@Internet: Children as Multisensory Geographic Creators. In Fernández Manjon, Baltasar, *et al.* (eds.), *Computers and Education: E-learning from theory to practice*. Springer Netherlands, pp. 57-66.