

# Trust Issues on Crowd-Sourcing Methods for Urban Environmental Monitoring

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## ABSTRACT

*This paper explores trust related issues arising from the use of a crowd-sourcing method. Crowd-sourcing is a relatively new method that utilises modern technologies to gather, analyse and visualise specific “on-the-fly” data. The data is typically acquired through the employment of mobile technology, with each device running a bespoke application that captures the desired information. The resulting “crowd sourced” data is readily available and the corresponding maps produced can in turn, be used to support strategic planning and to facilitate overall, more informed decision-making. The purpose is to provide insights into this novel approach to data collection, aggregation and subsequent visualisation. Specifically, the focus centres upon issues of trust and security that are inherent not merely to the use of crowd sourced data capture itself, but also crucially, to the stewardship and usage of the resultant data sets within e-government settings. A novel community centric usage scenario is presented that seeks to show how issues of trust pervade the technology. Hence, both rewards and risks are revealed and we go on to outline a preliminary approach intended to support a trusted and reputable “crowdy” data architecture.*

*Keywords: Crowd-Sourcing, E-Government, Environmental Monitoring, Trust, Urban Monitoring*

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## INTRODUCTION

Pioneering studies have been undertaken that have proven the potential worth of so-called “crowd-sourced” mobile phone data (Paulos, 2009; Bessis, 2010; Bessis *et al.*, 2010; Sotiriadis *et al.*, 2010; Asimakopoulou & Bessis,

2011). Several pilot studies have shown that mobile phones and mobile sensors can be used by ordinary “citizens” to gather environmental data in urban settings. Mobile sensing is still an emergent area where the costs and benefits are still rather hard to determine because it is still so early in the research cycle. Air quality in a WHO (World Health Authority) sponsored study (WHO, 2006) in Accra (Ghana), has

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been gathered by Taxi drivers and various pilot systems have been and are being developed now to capture urban temperature and noise levels (Maisonneuve *et al.*, 2009). The aim is to create real-time and dynamic environmental “maps” which in turn are used to produce environmental reports, thus informing urban planning strategy and policy decision making as well as serving to monitor individual health levels and welfare (Bessis, 2010). Paulos (2009) has coined the term “citizen science” for solutions that seek to leverage collective citizen based data collection. However, participatory data collection activities of this kind and their subsequent aggregation and analysis by decision makers pose potentially serious concerns as regards security and privacy. For example, users equipped with GPS (Global Positioning Software) enabled mobile devices necessarily reveal location and contextual information as they upload data to a central data repository. Similarly, the mobile devices themselves may be exposed to risks associated with their enablement as crowd sensing devices. One concern is how best to ensure privacy whilst uploading useful information. Users may wish only to share certain directly observed data-sets to ensure their anonymity. Downloading an “app” may expose the device (hence user) to “malware” or other security infection risks. Modification of mobile devices via the installation of sensors risks the installment of so-called “Trojans”.

In a wider context, there are clearly relevant issues of “social capital” (Putnam, 2000; Hardin, 2002) thus, high-level organisational trust and reputation issues also need to be addressed if “citizen science” is to be adopted successfully to aid decision makers. Citizens need to have trust in a “civil society” and trust planners need to ensure that the data gathered by citizens is used to for the benefit of citizens and not to used merely to defend vested interests. Similarly, decision makers (such as those within e-government contexts) will need to rigorously enforce citizen data protection rights and ensure that individual rights and data privacy are maintained and not compromised by such systems. E-governance issues are raised and as with Cloud platforms

organizations need to carry out effective risk assessments well before systems are enabled. That is, suitable safeguards need to be in place so as to achieve a fair balance as between the rights of citizens and the responsibilities of decision makers operating within “civil society” organisational contexts, such as e-government.

This exploratory paper seeks to offer a critique of relevant trust and security issues associated with this particular form of collective computational intelligence (Bessis, 2010). In so doing we seek to present an analysis at the social, pragmatic, semantic, syntactic and empiric levels of abstraction, whilst also presenting a balanced risks vs. rewards analysis of crowd-sourcing within a given scenario, which is typical of urban environmental monitoring and decision making contexts. We offer some potential solutions by which this exciting technology including mobile mediated data collection can best be exploited (but not misused) by decision makers operating at a local level.

We base our analysis not only on rigorous conceptual foundations, derived from a semiotic paradigm as applied to e-Service trust contexts (French, 2009) but also as derived from a “scenario” based on a realistic local government adoption setting. The aim is to not only provide an up-to-date account of the state-of-the-art environmental monitoring via crowd-sourcing, but also to provide a suitable analytic framework (that is a trust “ladder”, see: French, 2009) that can be used to generalise beyond environmental specific data collection to other types of crowd-sourcing contexts.

This paper is an extended work of French *et al.* (2010). The aim here is twofold: firstly, to provide a brief overview of relevant trust and security issues. Secondly, to present a case scenario, within which we discuss the risks vs. rewards of the crowd sourcing as well as present a fit for purpose preliminary trusted and reputable data architecture.

## TRUST AND SECURITY ISSUES

Many kinds of deception on the web involve low cost identity signalling which engender

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