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Privacy-preserving computation of participatory noise maps in the cloud

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Title:	**Privacy-preserving computation of participatory noise maps in the cloud**
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Abstract:	This paper presents a privacy-preserving system for participatory sensing, which relies on cryptographic techniques and distributed computations in the cloud. Each individual user is represented by a personal software agent, deployed in the cloud, where it collaborates on distributed computations without loss of privacy, including with respect to the cloud service providers. We present a generic system architecture involving a cryptographic protocol based on a homomorphic encryption scheme for aggregating sensing data into maps, and demonstrate security in the Honest-But-Curious model both for the users and the cloud service providers. We validate our system in the context of NoiseTube, a participatory sensing framework for noise pollution, presenting experiments with real and artificially generated data sets, and a demo on a heterogeneous set of commercial cloud providers. To the best of our knowledge our system is the first operational privacy-preserving system for participatory sensing. While our validation pertains to the noise domain, the approach used is applicable in any crowd-sourcing application relying on location-based contributions of citizens where maps are produced by aggregating data – also beyond the domain of environmental monitoring.