Sensorium — A Generic Sensor Framework

Albert Rafetseder, Florian Metzger,
Lukas Pühringer, and Kurt Tutschku
University of Vienna, Austria
albert.rafetseder@univie.ac.at

Yanyan Zhuang
University of Victoria, Canada
yyzhuang@cs.uvic.ca

Justin Cappos
Polytechnic Institute of NYU, USA
jcappos@poly.edu

I. Introduction

Modern computing devices, including smartphones, laptops, and tablet computers, are equipped with an increasing number of sensors and data sources, ranging from accelerometers to 3G radio information. But different devices and platforms such as Android and iOS use very different interfaces for sensors access. There is no common way to access and facilitate this data for networking experiments. Privacy is another issue hardly tackled on any platform other than in a crude binary (allow/deny access) way.

Therefore, we introduce Sensorium[1], a generic sensor reading framework that funnels data from actual sensor drivers, implements fine-grained privacy control for the user, and provides a generic outbound interface. An example application using Sensorium is Open3GMap[2], which visualizes mobile coverage using collected data.

The challenging task of implementing specialized sensor applications is simplified by providing a generic framework for interfacing sensors and making them available to other applications. In our current implementation for Android, many sensor drivers are already implemented. Since giving access to sensor data also exposes the user's privacy, the user can disable or set privacy levels for each sensor individually, and display all sensor readings that would be shared.

Open3GMap showcases the sensors framework. It comprises a web service displaying 3G coverage data at their corresponding GPS locations collected by devices running Sensorium. This solves a real-world problem: Mobile operators as well as corporations like Google and Apple collect these data, but never make them publicly available in raw form to anyone else. This is not true for Open3GMap: We provide all measured values as Open Data.

II. Architecture and Implementation

Figure 1 overviews Sensorium's architecture components. It interfaces with sensors to read and collect sensor values, and those parts of Open3GMap that collect measured data on the device. In the current version of Sensorium available for Android, we provide sensor data for generic device information, mobile radio and location data, and WiFi and Bluetooth information. The data is prepared for local display, e.g. in a GUI or status widget. Additionally, a user-configurable

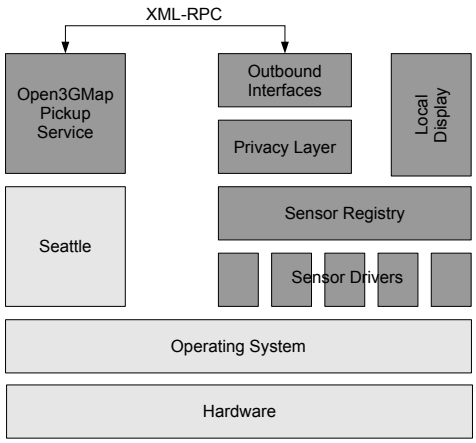

Fig. 1. Sensorium architecture with Open3GMap data pickup.

privacy layer allows for either full sensor access, reduces the precision of values (by rounding or hashing values) for improved privacy, or denies access to sensors. Finally, other applications running on the same device are free to connect to Sensorium's outbound interfaces and register for sensor updates or poll data through an XML-RPC library (as shown exemplary for Open3GMap here).

The sensor value pickup code for Open3GMap runs inside the cross-platform Seattle[3] runtime, and allows for secure and remote access to collect the data. The example application we implemented to make use of the data, Open3GMap, is based on JavaScript and OpenLayers.

Due to the layered architecture, it is very simple for contributors to add their own implementations of layers or swap them out for their own altogether. To create a new sensor driver, only code interfacing the actual sensor and the lightweight API into our sensor registry need to be implemented. Similarly, additional local display methods, privacy enhancements, and outbound interfaces might be written.

III. Conclusion

Sensorium attempts to bring the sensing capabilities of modern devices to a broader range of developers and experimenters through a simple-to-use XML-RPC based interface. Using the framework or adopting the available source code gives everyone the chance to build projects like the Open3GMap mobile network coverage Web service we presented.

[1] https://github.com/fmetzger/android-sensorium
[2] http://homepage.univie.ac.at/albert.rafetseder/o3gm/
[3] https://seattle.cs.washington.edu/