Bauhaus-Universität Weimar

CML://

Sens-ation

Sensor Infrastructure

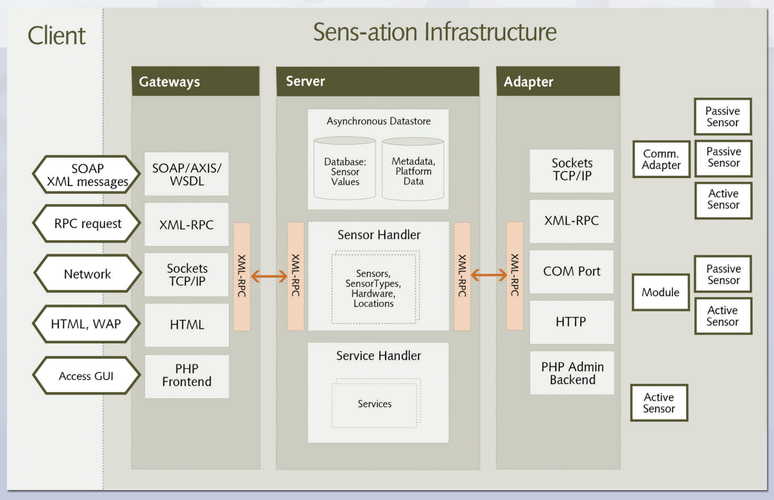

Figure 1: The sensor infrastructure on the server. Three major parts are to be distinguished: gateways, server and adapters.

Figure 2: This client requests values from the selected sensors and the user receives an indirect feedback. If the visualization feedback is chosen, a second window opens with an animation and the sensor values control the speed of the three moving spots. The sound feedback controls the volume of iTunes depending on the sensor's values.

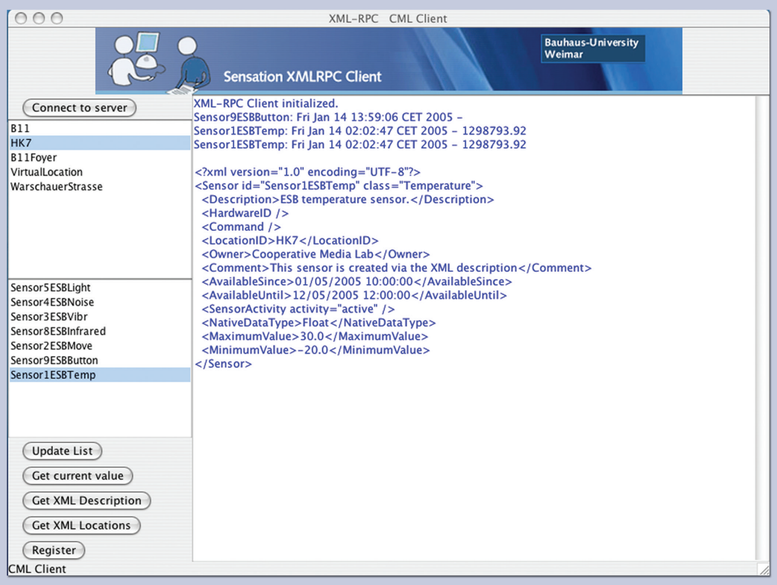

Figure 3: XML-RPC Java clients can register themselves for distinct sensors. They are automatically notified by a message and create sounds if the case of an event.

The objective of this research project was the development of a **client-server infrastructure providing sensor information from sensors to various clients**. It allows to construct intelligent reactions of software or hardware objects (e.g. light sources) depending on the discovered environment. An example of such a system is a computer which reacts upon noise and movement in an office to activate an e-mail client or to start other software.

For sensor access it is necessary to protect the sensor hardware from simultaneous access by multiple clients. The solution of this problem is to use a sensor handler as virtual interface. The **sensor handler** acts as a kind of buffer between client and sensor modules, which accumulates and stores sensor information in a database. On the server side the **gateway modules** then provide the interface for clients to access all sensor values they need.

A major feature of the server infrastructure is the provision of simultaneous access to sensor information and a common interface for all registered sensor modules. The adapters encapsulate and hide all specific implementation details of the hardware (see Figure 1). New sensors, hardware modules, sensor types and locations can be registered easily using XML descriptions. **Adapter modules** provide miscellaneous interfaces for the notification of new sensor events, e.g. XML-RPC, sockets or HTTP connections. Beyond real sensor hardware (measuring the current temperature, light intensity or movement) more abstract sensors (mobile sensor, messenger awareness, etc.) can be integrated, as well.

Clients connect via different gateways: XML-RPC, AXIS Web Services (SOAP), sockets or HTTP connections. They can communicate in two different ways with the server: they can either connect just for a single value of a sensor or a collection of sensor values, or they register themselves to be notified when events of a specified sensor occur.

For the aggregation and interpretation of sensor values, **high level services** can be integrated **as software modules** into the infrastructure. For example, services may calculate a variety of heuristics from current and saved sensor information. These calculated values will then also be available via our public service interface. If a client requests sensor values, the server may transmit not only the current value but also the prospective values for the next hours.

Furthermore we have implemented **different sample clients for desktop hardware and mobile devices**. These clients demonstrate the rapid development of clients to access the saved sensor values provided by the central server. The clients use the Java programming language, as well as AppleScript (Apple scripting language), PHP or J2ME for mobile clients (see Figure 2 to 6).

For further information see:
http://cml.medien.uni-weimar.de/sens-ation

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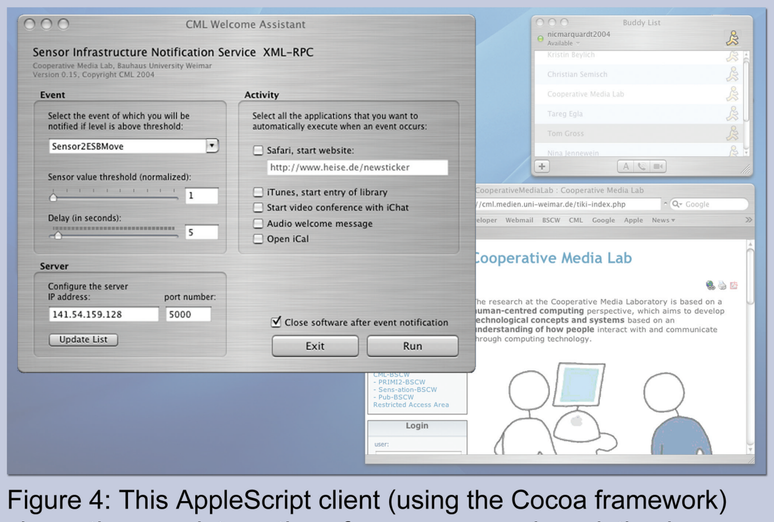

Figure 4: This AppleScript client (using the Cocoa framework) shows the easy integration of sensor access in scripting languages. The client can control applications dependent on received sensor events.

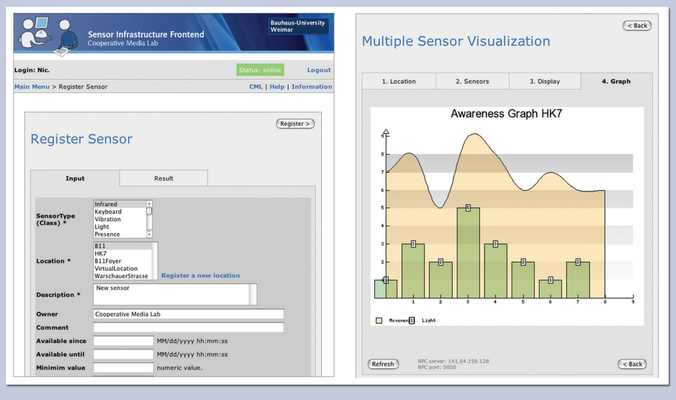

Figure 5: Two screenshots of the web browser user interface: Register new sensors (left), request sensor values in real time or using the database values (right).

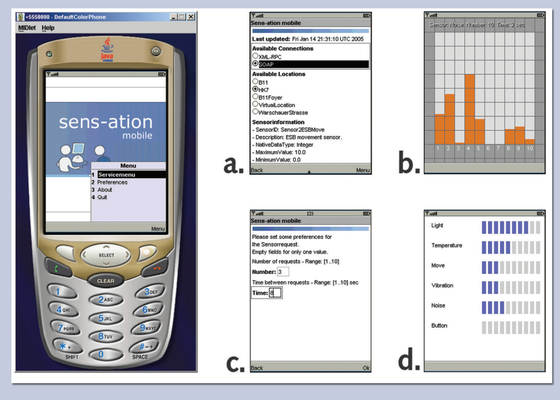

Figure 6: Mobile J2ME client: Display available connections, locations and their sensors and additional sensor information (a), visualization of noise-sensor with 10 requests (b), set the preferences for sensor request (c) or display scaled sensor data of 6 different sensors (d).