tinyLAB: A Matlab-Based Framework for Interaction with Wireless Sensor Networks

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I. Demo Abstract

The first steps towards a wireless sensor network deployment often include a preliminary stage in which sensor data is collected, visualized and carefully analyzed. In this stage, developers often undergo a time-consuming procedure logging data first and analyzing it later with standard or ad-hoc tools. The possibility to visualize and process the sensor data and interact with the network (e.g., to change the current sampling rate) in real-time could therefore ease and speed-up the preliminary data analysis, as well as support debugging and network inspection in a later stage. To this scope, a bunch of tools have been designed and developed within, but unfortunately not always distributed to the research community [1]–[4]. Furthermore, such tools are usually tailored to specific applications or needs and thus provide limited or constrained functionalities. The Matlab computing environment, on the contrary, is widely used across different scientific communities and is therefore particularly well-suited to serve as a generic data managing platform also in the context of wireless sensor networks. Indeed, the TinyOS software suite includes a collection of Matlab scripts that allow to access and use the TinyOS Java toolchain, thereby providing basic primitives to interact with a sensor network from within Matlab. However, this solution requires binding Matlab to the TinyOS tools and thus limits flexibility and portability.

```
1 %testTinyLAB tinyLAB example application
2
3 src=PacketSource('new','serial@COM1:tmote');
4 sink=PacketSink(7,'this','basic','testFcn');
5 PacketSource('bind',src,sink);
6 startReceiving(src);
```

To overcome these limitations, we developed tinyLAB, a simple framework completely implemented in Matlab that allows to receive and send messages from and to a TinyOS1.x-based sensor network. Avoiding any cumbersome installation procedure, tinyLAB enables using the full Matlab computing power to manage incoming messages, process, store and visualize data as it comes from the network, as well as to send controls to specific nodes or the whole network. To ease application development tinyLAB relies on the two basic abstractions of *PacketSource* and *PacketSink*. A *PacketSource* basically wraps a communication channel, like a serial or TCP/IP port, and provides *PacketSink*s with properly parsed packets. A *PacketSink* declares interest in all or specific messages coming from a *PacketSource* and defines the payload parsing modalities as well as further operations to execute on the incoming data. For instance, the code snippet in this page shows a simple tinyLAB application instantiating a *PacketSink* that will receive (from a *PacketSource* wrapping the serial port $COM1$) packets with AMtype 7, that will in turn beforwarded to the `testFcn` callback function for further processing. The tinyLAB framework, along with a user guide and application examples, is available for download at www.inf.ethz.ch/personal/santinis/research/code/ . We are currently extending the framework to support also tinyOS2.x-based networks and we plan to distribute the next version of tinyLAB through the Matlab Central File Exchange platform [5]. We demonstrate tinyLAB by running, and modifying on-demand, a test application that collects, processes, visualizes and stores data received in real-time from a small network of *Tmote Sky* sensor nodes.

References

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[3] R. Guy et al., "Experiences with the Extensible Sensing System ESS," UCLA Center for Embedded Network Sensing, Tech. Rep. 01-310-825-3127, January 2006.

[4] B. Greenstein et al., "A Sensor Network Application Construction Kit (SNACK)," in *Proceedings of the 2nd Intl. Conf. on Embedded Networked Sensor Systems (SenSys'04)*, Baltimore (MD), USA, November 2004.

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