BeTelGeuse: Tool for Context Data Gathering via Bluetooth

Patrik Floréen, Joonas Kukkonen, Eemil Lagerspetz
Petteri Nurmi and Jukka Suomela

Helsinki Institute for Information Technology HIIT
Basic Research Unit
Department of Computer Science, P.O. Box 68
University of Helsinki, FI-00014 Finland
{firstname.lastname}@cs.helsinki.fi

Activity related information is often seen as a good indicator for human behaviour, see e.g. [1–5] and, as a consequence, context-aware applications and services need access to activity related context data. In mobile and wearable computing, the dominant approach has been to build customized sensor boards (e.g. Muffin [6]) and armbands or other fabrics (e.g. The Bodymedia SenseWear PRO$_2$ Armband [7]) which are equipped with sensors that provide physiological information (e.g. galvanic skin response, acceleration, heart rate). The decrease in the prices of Bluetooth sensor chips has made another alternative viable. Namely, sensors with Bluetooth capability can communicate their measurements via Bluetooth to mobile devices and the data can be analyzed directly on the device. However, currently generic tools that can be run on different platforms are not available and this hinders development and research in the fields of pervasive and mobile computing. To improve the situation we have developed a Java-based tool, BeTelGeuse, that can be used on any MIDP 2.0 [8] compliant device that supports the CLDC 1.1 profile [9] to which a JSR-82 compliant Bluetooth stack [10] is available. Our tool is freely available under the LGPL license and it has been tested with the following configurations: laptop running Windows XP, desktop computer running Windows 2000, desktop computer running Linux, Nokia 6680, Sony Ericsson W800i. In our demonstration we show how the tool works and give information on how to use and extend it.

In previous research, data gathering tools have been developed for specific environments. For example, the Context Watcher [11] and the ContextPhone [12] run on Nokia Series 60 [13] phones. The Context Watcher can gather GPS, heart rate, speed and distance information whereas the only physiological information that Context Phone currently supports is GPS information. Closest to our work is the IBM Mobile Health Toolkit [14], which contains a MIDP application that runs on a mobile phone and which uses a specific set of health sensors (part of the kit) to gather remote medical data. The main difference is that our tool is not restricted to a specific set of sensors, but it can be easily extended to use additional sensors.

The BeTelGeuse allows defining rules that can be used to define which parser to use to read data from a particular Bluetooth device. This way Bluetooth sensors can be discovered automatically and the correct parsers can be automatically

initialized. At the moment we have parsers for a GPS device and for a Suunto ANT-2-BT module, which allows us to obtain heart rate, distance and speed information.

The BeTelGeuse runs periodically a Bluetooth device discovery and, if new devices are found, initializes the appropriate parsers. Thus, the tool can discover new devices while running. In addition, if a connection to an existing device is lost, the BeTelGeuse automatically tries to re-establish the connection. If the connection cannot be established on the first retry attemp, an exponential backoff is used so that, the longer time ago the connection died out, the rarer the retry attemps are. The architecture of the BeTelGeuse is modular so that new parsers, as well as other components, can be easily added to the tool later on.

References

1. Isbell, Jr, C.L., Omojukon, O., Pierce, J.S.: From devices to tasks: automatic task prediction for personalized appliance control. Personal Ubiquituous Computing **8** (2004) 146–153
2. Desai, N., Kaowthumrong, K., Lebsack, J., Shah, N., Han, R.: Automated selection of remote control user interfaces in pervasive smart spaces. In: Proceedings of HCIC Workshop on Pervasive Smart Spaces. (2002)
3. Moeslund, T.B., Granum, E.: A survey of computer vision-based human motion capture. Computer Vision and Image Understanding **81** (2001) 231–268
4. Philipose, M., Fishkin, K.P., Perkowitz, M., Patterson, D.J., Fox, D., Kautz, H., Hähnel, D.: Inferring activities from interactions with objects. IEEE Pervasive Computing **04** (2004) 10 – 17
5. Chen, J., Kam, A.H., Zhang, J., Liu, N., Shue, L.: Bathroom activity monitoring based on sound. In: Proceedings of the 3rd International Conference on Pervasive Computing (PERVASIVE). Volume 3468 of Lecture Notes in Computer Science., Springer-Verlag (2005) 47 – 61
6. Yamaba, T., Takagi, A., Nakajima, T.: Citron: A context information acquisition framework for personal devices. In: Proceedings of the 11th International Conference on Embedded and Real-Time Computing Systems and Applications, IEEE (2005)
7. : BodyMedia Healt Monitoring System. http://www.bodymedia.com/main.jsp (2006)
8. : Mobile Information Device Profile. http://java.sun.com/products/midp/index.jsp (2006)
9. : Connected Limited Device Configuration (CLDC) 1.1. http://jcp.org/aboutJava/communityprocess/final/jsr139/index.html (2006)
10. : Java API for Bluetooth. http://www.jcp.org/en/jsr/detail?id=82 (2006)
11. : Context Watcher. http://www.lab.telin.nl/ koolwaaij/showcase/crf/cw.html (2006)
12. Raento, M., Oulasvirta, A., Petit, R., Toivonen, H.: ContextPhone: A prototyping platform for context-aware mobile applications. IEEE Pervasive Computing **4** (2005) 51 – 59
13. : Nokia Series 60. http://nokia.com/series60 (2006)
14. : IBM Mobile Health Toolkit. http://www.zurich.ibm.com/mobilehealth/ (2006)