Efficient and Unobtrusive Wearable Interaction: A Sensing Wireless Data Glove

Hendrik Witt and Holger Kenn
University of Bremen
Center for Computing Technologies

Am Fallturm 1, D-28359 Bremen
Phone: +49 (421) 218-7809
Fax: +49 (421) 218-7820

Email: {hwitt, kenn}@tzi.de

Keywords: Wearable Computing, HCI, Data Glove, Interaction Device, Sensor-Board

Abstract

One challenge of wearable computing is the design and use of interaction devices for wearable applications that are accepted by users. In our previous work, the Winspect [1] project, a wearable system for crane maintenance was constructed that used a multitude of cable connections to attach a data glove interaction device, an external battery pack, ultrasound emitters and receivers, a RFID scanner, and a head-mounted display, to a wearable computer. However, the presence of these cable connections led to the rejection of the Winspect prototype by the industrial partner due to work safety considerations.

In order to close the gap between a multitude of devices that are connected to a wearable computer by cable and a textile electronics system that integrates all sensing capabilities into the textile fabric, sensor-boards are needed. With SCIPIO, we built a sensor interface system as a basis for building various wearable interaction devices. SCIPIO's features include

- small size and lightweight
- multitude of analogue and digital inputs and outputs
- Bluetooth wireless communication interface
- audio and visual feedback system
- energy-efficiency for battery operation

To evaluate the usability of the SCIPIO hardware regarding the requirements of wearable computing applications, we developed an interaction device that makes use of SCIPIO. The developed device is a data glove interaction device intended for use in explicit interaction.

For building the data glove, three kinds of sensors have been attached to the SCIPIO: A dual axis tilt-sensor is used for hand-rotation activities, e.g., to navigate through vertical lists. Three micro buttons have been integrated into fingers of the data glove to offer arbitrarily usable action triggers for an application. Finally, an RFID scanner has been placed at the side of the hand to let a user easily scan RFID tags, e.g. to determine a location context. The visual feedback system was used for basic status information such as connectivity or battery power,

whereas the piezo speaker has been used to give audio feedback if a RFID tag has been successfully scanned.

Figure 1: 3-layer concept of the wireless data glove

Besides hardware integration we designed a special wearing concept based on three different gloves that build the actual data glove. Figure 1 shows this layer concept. We chose the concept to provide an approach to hygiene directives required in several application domains when wearable computers are used, e.g., in the medical domain. Regarding this, the inner glove is used for hygiene purposes whereas the middle glove is used to fix the controller hardware as well as sensors and buttons. Finally, the outer glove can be chosen arbitrarily according to an application domain, e.g., a robust protection glove for maintenance tasks.

In this poster we presented a data glove interaction device for wearable applications. It is wirelessly connectable via Bluetooth to a wearable system. The 3-layer design of the data glove pays attention to restrictions in professional work environments, e.g. hygiene and safety considerations.

References

[1] M. Boronowsky, T. Nicolai, C. Schlieder, and A. Schmidt, “Winspect: A case study for wearable computing-supported inspection tasks,” in *Fifth International Symposium on Wearable Computers (ISWC ’01)*, vol. 5, IEEE Computer Society. IEEE Computer Society, 8–9 October 2001, pp. 163–164.