Context-Aware Mobile Learning for Reconnaissance and Surveillance

Alexander Streicher, Daniel Szentes, Bela-Andreas Bargel & Wolfgang Roller, Fraunhofer Institute for Optronics, System Technologies and Image Exploitation, Germany

Introduction

Mobile information systems can take the role of mobile knowledge brokers. They give access to a vast variety of information sources at any given time or place, and they can satisfy the thirst for information and knowledge, for instance user manuals or learning material about a specific system. Mobile hand held devices, e.g. smartphones, can make mobile learning possible as they offer ubiquitous access to such learning material. In combination with the manifold sensors being embedded in modern smartphones new application scenarios based on mobile devices are emerging. One example is location-dependent mobile assistance where the camera images or the embedded GPS sensor are used for determining the user's location.

Application Context

This work shows the concept and the realisation of a location-aware mobile assistant and mobile learning application for an interconnected sensor- and robot-system. In this system different kinds of platforms, sensors and control stations are interconnected with each other to allow multi-sensor reconnaissance and surveillance [Seg11]. The different robotic platforms are land robots (unmanned ground vehicle, UGV), air robots and balloons (unmanned aerial vehicle, UAV) as well as mini-submarines (unmanned underwater vehicle, UUV). All of them can carry various sensor types like optical or infrared cameras, chemical sensors and gas sensors. In stationary or mobile control stations real-time situation reports from all platforms and sensors are aggregated and – to some degree – automatically analysed. The operator can control the active components (the robots and camera holders) via a pilot cockpit or by a top-view situation map using touch gestures. The application scenarios of the system can be military reconnaissance as well as civil surveillance and civil protection. One example is the German "Future Urban Security" program [Bun08] where scientists and emergency forces test and evaluate such systems in disaster scenarios for their qualification in assisting and protecting the human emergency forces [Ais11] (Figure 1).

Figure 1: *(left) Quadrocopter for reconnaissance in a disaster scenario, (right) smartphone with a mobile assistance and mobile learning program*

Because of the complexity and heterogeneity of this interconnected system the setup, operation and maintenance is challenging. To provide on-site support a mobile assistant with mobile learning capabilities has been designed and implemented. This smartphone-based "Mobile Tutor"

assists the users when they interact with the various kinds of sub-systems, for instance the land robot. To optimally assist the user in a specific situation on-site the mobile assistant recognises the current location and offers context-aware information and learning material.

Mobile Learning and MicroLearning – Didactic Strategy

The didactic strategy behind this work is based on the Microlearning concept where learning content is dissected into small, single learning objects [Ker07, HLB06]. Such learning objects are semantically self-contained and can therefore be presented detached from an overall course program. This is advantageous for mobile learning because the system can provide the users with just the right amount of content so that they can react appropriately just-in-time to an acute issue or question. In addition a context-aware mobile learning system can select that very learning content which fits best to the users' actual situation. For example in our scenario of a mobile robot system the context-aware mobile learning system can show the steps to set up a mobile land robot when the user wants to use the robot for reconnaissance. Users can react quickly to some question at hand and answer it by learning about this topic without the need to study a complete learning course.

Summary

The primary goal is to optimally assist the users on-site and to provide them with relevant learning content which fits best to their current working situation, i.e. the users' context. To achieve this, sensors of mobile devices are used to determine the current location and context of the user. The application scenario of this work is a mobile learning application for an interconnected sensor- and robot system for reconnaissance and surveillance. The context-aware mobile learning can be used on-site, it reduces the time users have to spend for research of appropriate information and learning material and it can increase the learning motivation since the presented learning content is highly related to the users' current situation.

References

[Bun08] Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung, BMBF): Forschung für die zivile Sicherheit. Bonn, Berlin, 2008.

[HLB06] Hug, T.; Lindner, M.; Bruck, P.: Microlearning: Emerging Concepts, Practices and Technologies after e-Learning. *Proceedings of Microlearning 2005. Learning & Working in New Media. Conference Series*. Innsbruck University Press, Innsbruck, 2006.

[Ker07] Kerres,M.: Microlearning as a challenge for instructional design. In *Theo Hug und Martin Lindner, Hrsg., Didactics of microlearning: concepts, discourses and examples*. Waxmann., Münster, 2007.

[Seg11] Segor, F.; Bürkle, A.; Kollmann, M.; Schönbein, R.: Instantaneous Autonomous Aerial Reconnaissance for Civil Applications. *ICONS 2011, The Sixth International Conference on Systems*. Januar 2011, S. 72-76