
Multi-Sensor Context Awareness for Mobile Devices

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Abstract

Within the many different kind of context possible and useful, especially the location tells many things about the user's overall situation. In turn, the knowledge about the user's context from other sources could also help to narrow down the possible location of the user if only an imprecise location is available.

GPS as the most popular system for location estimation fails inside buildings, where people spent most of their time. For a more general, reliable solution additional the augmentation with other positioning sensing techniques is needed. Possible approaches are inertial sensors, also useful for activity recognition, and widely available radio beacons like GSM and WiFi.

Keywords

Multi-modal context awareness, positioning, pedestrian navigation, sensor fusion

Problem Statement and Research Question

Motivated by the goals of the MOBVIS[1] project, I would like to investigate multimodal context acquisition, especially in terms of

- users context, focusing on
 - reliable positioning
 - user orientation and body posture
 - user activity

- semantic location using intelligent maps)
- Task context
- Digital context (connectivity)
- Context of environment (people around)

Main focus is a continuous space of visitor scenarios, ranging from a first time visitor with main interest in navigation to a permanent visitor with focus on capture&access.

Connected research interests are the possibilities for pedestrian navigation by multi-sensor fusion, including inertial sensors, WiFi, GSM and GPS, and enhancement of imprecise results by context knowledge about the users context and map information.

Approach and Methodology

Much of the research is of experimental nature. The first steps will be the building of miniaturized, reliable positioning platform for long term recordings, exploring the possibilities of step recognition/step length estimation with body-worn sensors as well as evaluation existing positioning techniques, e.g. dead reckoning modules, WiFi/GSM positioning (Placelab) and GPS availability. A possible direction of further research is not quite settled yet, but could be in the use of fewer and simpler sensors, compensated by the use of context information.

Related Work

In the field of pedestrian positioning by GPS combined with dead reckoning is done a lot of work, to emphasize is the early work of Judd [2] and the work of Ladetto [3], which yielded in commercial products. These approaches use sensors near the body's center of gravity and indirect step length estimation. Strapdown integration of shoe mounted inertial sensors

is presented by Foxlin [4]. An interesting different approach is presented by Eric Foxlin with. In Fang et al. [5] the implementation of dead reckoning with networked sensors and a survey on pedestrian navigation is presented.

The authors of "Place Lab: Device Positioning Using Radio Beacons In The Wild" [6] present a open source system for positioning based on fixed radio beacons, such as WiFi-Accesspoints and GSM base stations. This system focuses more on an inexpensive, pervasive positioning solution than on precision.

References

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