An Indoor/Outdoor Personal Positioning System for Pedestrian Navigation

Masakatsu Kourogi, Takashi Okuma, Takeshi Kurata
National Institute of Advanced Industrial Science and Technology (AIST)

What is demonstrated?

Two pedestrian demonstrators show the real-time performance of the **personal positioning** system. Their positions (and altitude) are visualized with the surrounding 3D space by the Google Earth. Each demonstrator is equipped with a handheld PC (w/ a GPS receiver) and a sensor module attached on the user's belt.

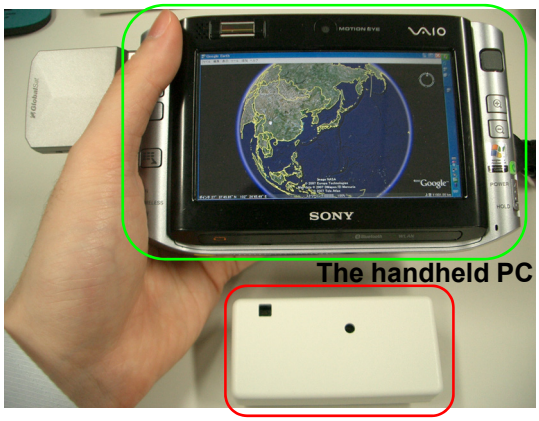

Fig. 1 The demonstration system

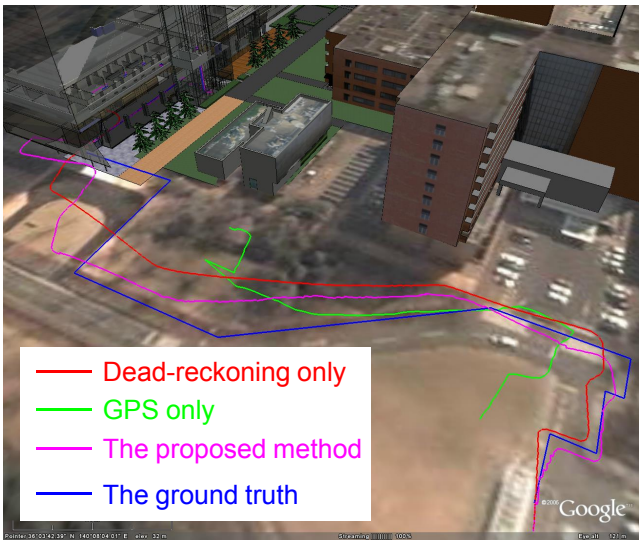

Fig. 2 The results of off-line experiments

The key technologies:

There are two key technologies deployed in the demonstration. The first is a method of **dead-reckoning** based on human walking locomotion analysis with Kalman filter framework by self-contained sensors (3-axis accelerometers, gyrosensors and magnetometers). The length of stride is estimated from amplitude of stabilized acceleration. Motion recognition is also implemented to detect walking upstairs/downstairs. The walking direction (attitude) is selectively compensated by the Earth magnetic field to counter drifting effect caused by output of the gyrosensors. The second is **GPS augmentation** to the dead-reckoning as for the stride and the walking direction where the GPS signal is available.

The demonstration system and its diagram:

We have constructed a personal positioning system (total weight: 650g) for pedestrian navigation. The system is composed of Web-based software components so that each of them can be connected by the standard Web-based APIs. The personal positioning system outputs the location and direction by CSV or NMEA-0183 format to be easily coordinated by mapping software such as the Google Earth.