# A WLAN based localization system for a mobile robot

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For navigation and path planning problems of a mobile robot, a precise localization of the system is required. For outdoor applications, regular GPS, differential or assisted GPS (AGPS) receivers are suitable solutions for localization. GPS signals are still to weak to be used indoors, even AGPS solutions do not work properly in a typical laboratory environment today.

Well known indoor sensors for mobile robots are laser scanners and supersonic sensors. But similar to GPS signals from inexpensive and standardized WLAN access points can be useful to assist a sensor fusion for indoor localization. An existing infrastructure of WLAN access points can be reused for this purpose.



Figure 1: Long time localization measurement (big red cross:real position, red circles:calibration points, lilac crosses:estimated positions

Our earlier approach to use Wireless LANs following the IEEE 802.11b standard for localization [1] was based on commercial software. Known approaches for WLAN based localization are cell detection (proximity), finger printing and triangulation of signals received. Depending on the small distances in WLANs, it is impossible to use the arrival time of the signals to compute the distance to each access point. Just the signal strength can be used for triangulation. In indoor environments, field strength spreading is very complex because of reflections and attenuations of signals.

We have developed a solution, which calculates the geometric mean value of the three best fitting WLAN reference points to estimate the robots position. Finger printing and triangulation methods are implemented. A visualization module, a WLAN spotter component, WLAN tools for calibrating of reference points and a configuration database have been developed for the Linux operation system. The tool set is easily integrable into a multi-sensor fusion based localization system for an pioneer 3 AT mobile robots.
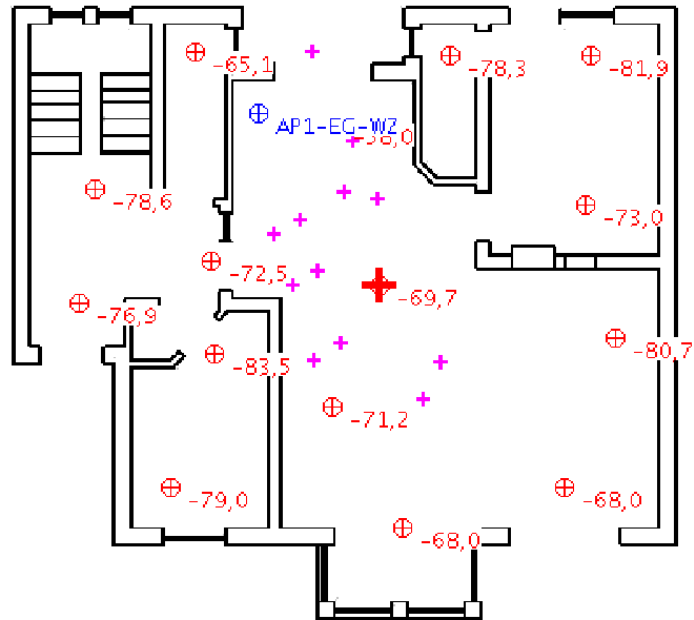
[1] `http://prt.fernuni-hagen.de/~bischoff/research/bischoff_jb2003_2.pdf`

[2] Gerhard Gubernator, Ein WLAN-basiertes Lokalisierungssystem für einen mobilen Roboter unter Linux, diploma thesis, Lehrgebiet Prozesssteuerung und Regelungstechnik, FernUniversität in Hagen, 2007