Title: End to End Continuous Indoor Positioning

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Abstract:
GPS receivers are found on nearly every smart phone today enabling a wide range of location-based services such as mapping, search, and navigation. Users expect their devices to work in all environments including indoors, parking garages, and in dense urban canyons. Recent advancements in Assisted-GNSS technology have enabled improved positioning indoors, but GNSS receivers are still not sensitive enough to determine position everywhere that users carry their devices. Any solution to improving coverage and accuracy indoors must be low cost and low power.

This paper introduces a new product from CSR Technology, Inc. – the SiRFstarV location chip with SiRFusion. The latest in a family of innovative GPS chips, this ground-breaking receiver combines the latest A-GPS and A-GLONASS advancements with Wi-Fi positioning and dead reckoning using low-cost Micro-Electro-Mechanical Systems (MEMS) sensors. Smart phones are equipped with an increasing array of MEMS sensors including accelerometers, magnetometers, gyroscopes, and barometers. The SiRFstarV chip acts as a gateway to receive input from all available MEMS sensors so that the output signals can be combined with the GPS, GLONASS, and Wi-Fi measurements. The observations from all of these sources are fused together using a Kalman Filter. Smart location management is employed to make use of the best combination of sensors at any given time in order to maximize coverage and accuracy while keeping power draw to a minimum. The result is continuous position availability in indoor environments.

To achieve these results, the system also uses data from a cloud based server for A-GPS, A-GLONASS, extended ephemeris data, and Wi-Fi positioning data. The improved coverage and accuracy indoors allows the system to crowd source the location of Wi-Fi access points indoors to a better level of accuracy than previously possible without surveying the sites. This in turn allows devices even without MEMS sensors to perform better than previously possible indoors without the need for surveyed infrastructure.

This paper describes the architecture of SiRFstarV, SiRFusion and SiRFCloud architectures and a typical application in a handset. The end-to-end system is described including the server components and measurement fusion approach. Performance measurements in real-world environments are presented.