TECHNOLOGY

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Method for Determining Position of a Wireless Device

TECH ID #: 524.26

Background

A team of researchers from the University of Calgary's Geomatics Engineering department and Electrical & Computer Engineering department has developed a novel positioning estimation technique that can be used by any positioning device to identify and eliminate **outliers**. These outliers are normally found in the received signal due to multipath and weak signal reception (threshold effect).

There are several positioning techniques for locating or fixing wireless devices within infrastructure systems, particularly where the device is capable of receiving/transmitting a radio signal transmitted/received from/by reference stations having a known position. For instance, localization of a device may be achieved by estimating ranges (i.e. distances) between the device to be located and the reference stations using know "ranging measurement techniques" such as, for example, received signal strength, time of arrival, round trip delay, and time difference of arrival based techniques. These techniques, however, suffer from ranging (**propagation delay errors**), and it is therefore a main objective of a positioning technique to minimize the effect of the ranging measurement error on the positioning error.

This invention uses a novel skew normal outlier detection (SNOD) technique which employs a four step process shown in figure 1 to obtain the final position estimate:

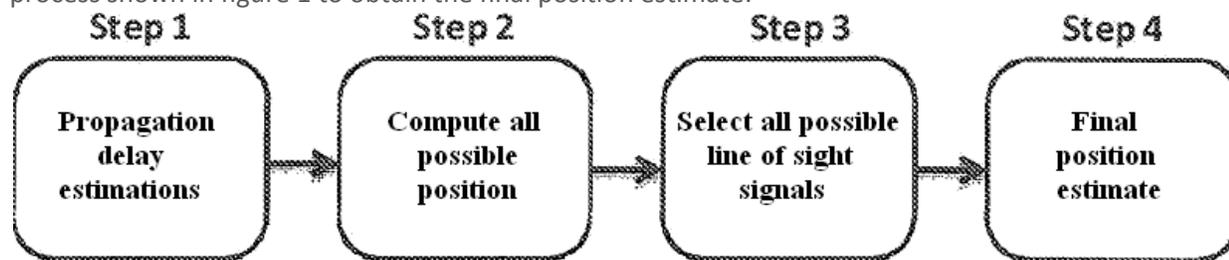| Step 1	Step 2	Step 3	Step 4
Propagation delay estimations	Compute all possible position	Select all possible line of sight signals	Final position estimate

Figure 1

It is a robust detection technique, which can detect and reject the biased propagation delays regardless of either the distribution of propagation delay estimates or the propagation environment. More specifically, the present method provides a positioning technique that **reduces** the effect of **ranging measurement error** on the **positioning error**.

Area of Application

- Person/Asset tracking
- Enhanced 911 services
- Location sensitive billing
- Intelligent transportation systems
- Location based games and other location based services (LBS)

Competitive Advantages

- This technique provides better sensitivity to detect direct path signals
- This technique accepts multiple potential propagation delay estimates per reference station (i.e. Cellular Base Station, GNSS Satellites)
- Minimizes the effects of standard ranging errors, as well as outliers, significantly improving location estimates
- Doesn't require the assumption of the distribution of the propagation delay estimates
- Doesn't require any external source of positional information
- Low power consumption & fast computation
- It offers accurate positioning, which could be used for proximity based notifications like location based mobile advertising, location based games, resource tracking, etc.

Stage of Development

- Extensive computer simulations and testings have been conducted. These simulations covered the probability of detection and probability of false alarm. Simulation results demonstrate the capacity of the SNOD technique in detecting outliers.

Intellectual Property Status

- Patent Pending

Publications:

- Mohamed Youssef, "A Cross-Layer Design for Wireless Location", PhD Thesis, 2009