

A Study on Ranging Delay Accuracy of Sensor Node Using VLBI Type XF Correlation Technology

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The use of the sensor network is being paid to attention as an ubiquitous society infrastructure now. The sensor network is a technology that makes the Sensing technology cooperate with the wireless network technology. Physical environmental datum (temperature, humidity, light, sound, acceleration, and magnetism, etc.) are acquired in scattering the small sensor devices that is called sensor nodes to the environment. It is a technology that the sensor nodes communicate with multi-hop wirelessly collecting environmental datum that one of sensor nodes acquired itself with surrounding sensor nodes acquired and manage collectively in the base station in hand.

Now important problem on sensor network is power saving, security and localization etc. , especially, various researches are done for a localization. Sensor network localization method is RSSI and TDOA etc. . RSSI is a method of using the differential of signal strength. TDOA is a method of using the time difference of arrival of the electric wave. But these methods demand the high clock accuracy for an accurate time synchronization, and there is a problem of the propagation like the multipass etc. . These have not achieved at a definite measurement method.

We proposed the correlation processing system that uses VLBI (Very Long Baseline Interferometry) technique. It is a highly accurate measurement technology that receives the electric wave from a quasar away by several billion light-years and measures the distance between antennas away by several thousand kilos by the accuracy of each milli-meters. Actual processing calculates the cross correlation function of the electric wave that two antennas received, and FFT is done to the cross correlation function and the amount of the delay is calculated. The distance between baselines is derived from it. Because the electric wave from the sensor node is very slight, it can be considered that there is a slight radio source in the ground. So it is possible that using correlation processing of this VLBI method.

We developed XF type VLBI correlation processing program of the radio source of the ground system. In practice, four antennas were disposed in the indoor environment and the electric wave from the sensor node was received. As a result, the correlation of the electric wave was able to be obtained between each antenna baselines. Therefore, it succeeded in the construction of a consistent correlation processing measurement system from the electric wave reception to data processing and analysis by the VLBI method. Moreover, the method of processing a suitable correlation for the electric wave reception of the sensor node was examined. And the accuracy of the electric wave delay error margin between baselines was evaluated by the least square approximation.