

# An Information Addition Technique for Indoor Self-localization System Using SS Ultrasonic Waves

Hirofumi Yoshiga, Akimasa Suzuki, and Taketoshi Iyoda

Soka University

1-236, Tangi-cho, Hachioji, Tokyo, Japan

e-mail :e11m5235@soka.ac.jp

## ABSTRACT

In this paper, we proposed an information addition method for a 3-D indoor positioning system using SS (Spread Spectrum) ultrasonic waves, and evaluated the effectiveness of this method. The system using SS ultrasonic waves can measure a target position with high resolution, noise tolerance, and an ability of CDMA by SS code using limited transmitting channels. MLS (Maximum Length Sequence) is employed as the SS ultrasonic code. We aim at a positioning system for self-localization of robots in our system; a location of a receiver installed on a target can be measured with the SS signals from transmitters mounted on measurement area. The positioning system requires the coordinates of transmitters to calculate the target position. In conventional method, each channel was assigned to a transmitter uniquely, and the coordinates of the transmitter can be obtained from the associated channel number. To cover a large area, a new method to add positioning information of transmitters to SS signals was required. Therefore, an information addition method was proposed from a viewpoint on an analogy of ephemeris in GPS. In the GPS, a bit of information is added to some periods of MLS. In the case of applying straightly to the system with ultrasonic waves, however, bit-rate is not enough to notify the coordinates of a transmitter for real-time measurements. In the proposed method, communication with multi-bite was achieved in 1 period of MLS. For evaluating the effectiveness of the proposed method, an experiment to measure the distance was conducted with original hardware installed on this method. In this experiment, 4 bits, 8bits or 16 bits information in 1 period of the MLS, generated by 8-bit shift register, is applied respectively. The result showed that distance from transmitter to receiver and the information can be detected at the same time in each case.

**KEYWORDS:** Spread spectrum, Ultrasonic waves, Indoor positioning system, and Information addition