

# NUSBL: Non-Uniform Sequence Based Localization

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## ABSTRACT

For the localization competition, we propose to deploy an indoor localization system based on Non-Uniform Sequence Based Localization (NU-SBL) algorithm. NU-SBL algorithm works by dividing the two dimensional localization space into faces on the basis of the ranked RSS from the deployed stationary beacon nodes. The algorithm requires the scaled floor plan of the building and the location coordinates of the stationary beacon nodes. The NU-SBL algorithm utilizes adaptive beacon node transmit power to improve the localization accuracy.

## Keywords

Indoor navigation, Indoor localization, RSS measurement, Sequence based localization

## 1. INTRODUCTION

The system described in this work, which we propose to deploy in the IPSN localization competition, performs indoor localization on the basis of RSS measurements. The stationary beacon nodes periodically transmit beacons, and the target nodes measure RSS for each received beacon packet to come up with a ranked RSS vector which is then used by the algorithm to deduce the target node's location. The system consists of IEEE 802.15.4 based wireless devices and a server which runs the localization algorithm. The hardware and the workings of Sequence Based Localization (SBL) [3] are explained in brief in the next two sections.

## 2. HARDWARE

The system is implemented using battery operated TMote sky [2] devices which are programmed using Contiki. Both the stationary beacon nodes and target nodes are TMotes. The location of the target Tmote is calculated by the server on reception of the RSS vector. The location of the target mote can be monitored on any browser.

## 3. SEQUENCE BASED LOCALIZATION

SBL [3] utilizes periodic beacon transmission from the fixed beacon nodes. Target nodes receive these beacon packets and generate a RSS vector. A ranked version of this RSS vector called a sequence is then compared against a set of ideal sequences generated based on the known location of the beacon nodes. The co-ordinates corresponding to the best matched ideal sequence are then given out as

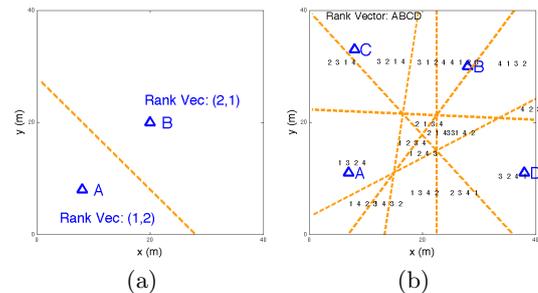


Figure 1: Sequence-based Localization. (a) Two Beacons - SBL Regions and Equal RSS line. (b) Four Beacons - SBL Regions and Equal RSS lines.

the localization result. This is possible because each sequence corresponds to a unique region in the 2-dimensional localization space, these regions are referred to as SBL faces. SBL exploits this unique geometric relationship for performing localization. SBL assumes all beacon nodes transmit at equal power, therefore the size, shape and the total number of faces only depends upon the number of beacon nodes and their positions.

NU-SBL [1] improves on SBL by modifying the transmit power levels of the beacon nodes such that the area of the largest face is minimized hence minimizing the error.

## 4. RESULTS

The accuracy of the system is evaluated using an in-house implementation in a office building at USC. In an area of about  $1650m^2$ , with 16 stationary beacon nodes the average system accuracy was evaluated at  $4.2m$ .

## 5. REFERENCES

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