IMPACT OF ANTENNA ORIENTATION ON LOCALIZATION ACCURACY USING RSSI-BASED TRILATERATION

Dominik Csík[1,2], Ákos Odry[1], Richárd Pesti[1,2], Péter Sarcevic[1]

[1]Department of Mechatronics and Automation, Faculty of Engineering, University of Szeged, Moszkvai krt. 9, H-6725 Szeged, Hungary
[2]Doctoral School of Applied Informatics and Applied Mathematics, Óbuda University, Bécsi street 96/B, H-1034 Budapest, Hungary
e-mail: csikd@mk.u-szeged.hu

ABSTRACT

The goal of the indoor localization is to determine the position and orientation of people, devices, and mobile robots. With the rise of Industry 4.0, wireless communication technologies have emerged as a rapidly evolving and crucial area for achieving this goal. Various radiocommunication-based technologies, including Bluetooth, Bluetooth Low Energy (BLE), Wi-Fi, Ultra-Wideband (UWB), and ZigBee offer means to indirectly estimate distance. These methods leverage diverse principles such as time-based measurements, signal strength, and angle of arrival. Indoor positioning systems can be categorized into two approaches: distance-based and distance-independent techniques. The Free Space Path Loss (FSPL) model describes the connection between distance and Received Signal Strength Indicator (RSSI). The parameters within this model significantly impact distance estimation and localization accuracy. Therefore, a method that accurately characterizes the model is critical. This work proposes an orientation-based localization technique utilizing RSSI and trilateration. Measurements were conducted between two ESP32 units in various orientations to obtain optimal parameters for each specific scenario. To assess the effectiveness of this approach, two scenarios were evaluated: one considering orientation and another neglecting it. The results show that incorporating orientation information leads to significantly more accurate positioning compared to the orientation-agnostic approach.

Keywords: indoor localization, fingerprinting-based methods, received signal strength indicator, radicommunication-based technologies