

Project Assignment: BLE AoA in a 3D environment

BouWatch develops systems for securing construction sites. The core product are mobile camera masts that are placed at the site. The cameras are capable of detecting trespassing and producing an alarm that is sent to a control room for validation and follow-up.

At such sites, a range of valuable manual tools is commonly in use. Equipping these tools with Bluetooth (BLE) beacons becomes increasingly popular. The recent 5.1 version of BLE allows locators to apply direction finding based on Angle of Arrival (AoA). This provides an opportunity to locate BLE devices, i.e., pinpoint locations of construction tools on site.

An initial research project investigated algorithms for BLE AoA estimation using an off-the-shelf linear antenna array. The project showed that the BLE AoA technology can provide an estimate of the angle with a reasonable accuracy for distances that are relevant to the BouWatch use case. The research also showed important shortcomings in the tested solution that relate to the antenna array. The project assumed a linear array. Such an array is limited to estimating the angle of arrival in a single (half)-plane, typically the azimuth angle. The use case however requires the angle to be estimated in two dimensions, both in the azimuth and elevation. This, in turn, requires a two-dimensional antenna array.

Assignment

The purpose of this assignment is to develop a solution for simultaneously estimating the azimuth and elevation of a BLE device using the BLE AoA technology. Some elements of this assignment are:

- Investigate the BLE AoA feature, in particular related to determining the angle in two dimensions;
- Design an antenna array that may be used for determining the angle in two dimensions;
- Design and optimize an algorithm for determining the angle in two dimensions;
- Build a proof-of-concept (PoC) demonstrator;
- Measure the performance in the PoC,

This assignment is conducted in close cooperation with the Radio Systems group at EEMCS/UT and the BouWatch research and development department.

Company

BouWatch is a young and successful international company providing construction site security and safety solutions. BouWatch is a market leader in this segment, and strongly growing. The company is also unique in having in-house control rooms, services people, production and research and development. The R&D is done by BouWatch Technology, which is mainly located in Enschede.

The BouWatch systems provide the safety and security on many very scattered locations throughout western Europe, and blend video, IoT and user information into a single system of relevant alarms and access control systems.