BLE Asset Tracking

# Triangulation Method Description

Thorold Tronrud, Software Engineer, StarFish Medical

# Input

As input, we will use the Gateway (receiver) RSSI for each beacon, and gateway positions. We will refer to the estimated distance between a receiver “N” (located at position xN,yN) and beacon (located at a true position of x,y) as RN

RN can be estimated from the RSSI with: where Z is the value of RSSI at one meter distance, and q is the signal attenuation coefficient through the environment. While q will vary in any real use-case, we can choose an average value for each gateway, based on its environment.

# Derivation

To triangulate, we require 3 receivers (A, B, C), located in non-degenerate positions in 2D space. For a given receiver, N:

We can re-order these terms to form:

With three receivers, we have three equations in this form, and two variables (x,y) to find. By equating the left hand terms of these equations, we can first solve for x in terms of y, and use that to find y in terms of constants.

We get:

And

With these terms, we can calculate the position of the beacon using only the estimated distance from RSSI, and the known gateway positions.