

Green Computing Project Abstract

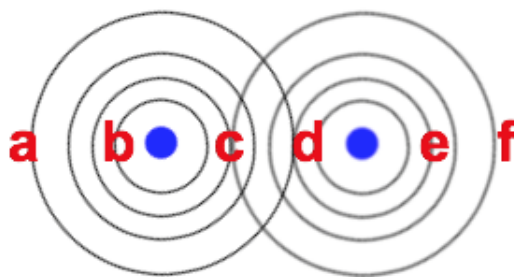
Nishad Gothoskar

ngothosk

Bluetooth Location System

In this project, we will construct a Local Positioning system using Bluetooth Low Energy hubs. Using an array of well-spaced and carefully positioned hubs we can aggregate estimated proximity data and predict the position of a user. There are two primary inspirations for this. The first is that having a sense of where people are in a building and how populated it is helps make more informed decisions on HVAC, power, etc. control. This can eliminate wastage of resources. The second inspiration is given that most users will be carrying some bluetooth enabled device and bluetooth is one of the least energy costly radios, its the best radio to use for this positioning.

The first and simplest model for positioning is shown below:



In this model, we can predict location by comparing signal strengths at two points. From A to B signal strength will increase in sensor 1 and sensor 2. From B to C, signal strength will remain consistent in sensor 1 but increase in sensor 2. From C to D, strength decreases in sensor 1 but increases in 2. From D to E, sensor strength decreases in 1 but remains about the same in 2. Finally, E to F causes sensor strength in both sensors to decrease. This is the simplest model for position detection along a straight line. A practical application for this relatively simple model is to track entrance and exit to a room i.e. Sensor 1 would go outside the door and Sensor 2 would be inside. Now a movement from A to F represents someone entering the room while F to A represents an exit. This is a useful tool to model room occupancy.

But this model can be abstracted to larger and more complex systems, to detect occupancy of larger scale buildings like the Gates building. But this comes with several obstacles:

- Being able to properly estimate proximity with the data the sensor provides
- Being able to passively detect bluetooth devices (no direct activation/connection)
- Being able to sample relatively often (refresh rate of sensor)

There are other directions in which this project can go. As discussed with the Google Physical Web team, they are working with bluetooth beacons. So where I could add elements of the "beacon" concept to this project is by providing users with access to population density maps of the building. And in general, even if I cannot pinpoint exact locations of users I can use these sensors to build a density/heat map of where people are in a building.