BLEProxiMesh: A Bluetooth Smart Mesh Network for Sensing Indoor Location

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Abstract

BLEProxiMesh is a low-cost, energy efficient sensor and access network for detecting the presence of people (or things) in a smart building. In particular, the sensor network facilitates the discovery and tracking of tags in a building, with a particular emphasis on security and emergency response applications.

The proposed system consists of Bluetooth Smart Tags and Beacons. Each Tag estimates its own position in the building based on pings received from nearby Beacons using Centroid localization algorithm and communicates its estimated position to the Beacon network through one or more nearby Beacons. This information is replicated throughout the Beacon network using the Trickle algorithm, which has been implemented using the GAP and GATT profiles of the Bluetooth Smart protocol stack. The system is designed to achieve a low-cost, energy-efficient, easy-to-deploy solution for data propagation and replication that is robust enough to be operational in emergency situations which not only involve power constraints but also power failure in the worst case. The system is dynamic and enables fast detection and propagation of changes in the network. The network is designed not only to provide a sensing platform but also to provide an access network for retrieving Tag information.

A working prototype has been implemented to validate the approach using a small-scale Beacon network. Future work will evaluate the performance of the system at scale.