

# Applications of Bluetooth Radio Technology and Indoor Positioning in the Hospital

Christian Howell  
*DeSales University*

Andrew Katz  
*Lehigh Valley Health Network, [andrew\\_j.katz@lvhn.org](mailto:andrew_j.katz@lvhn.org)*

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# Applications of Bluetooth Radio Technology and Indoor Positioning in the Hospital

Division of Education  
Christian Howell

Lehigh Valley Health Network, Allentown, Pennsylvania

## BACKGROUND

- Keeping track of the locations of objects, patients, and doctors is vital for the smooth operation of a hospital.<sup>2</sup>
- Radio technologies, including Bluetooth Low Energy (BLE), Wifi, & GPS, can assist.
  - BLE is preferred due to simple deployment of proximity and distance beacons.
- Deployment of multiple beacons in an array, combined with appropriate software, can inexpensively and easily be utilized for Indoor Positioning (IP).

## OBJECTIVES

- To explore the potential of Bluetooth Low Energy beacons in various functions within the hospital.
- Develop a proof of concept app that utilizes four beacons to provide detailed location reporting, and to successfully execute proximity and location notifications.
- Compare Estimote and Beaconstac, two competing beacon technologies.

## METHODS

- Wrote a literature review to provide background on potential uses of Indoor Positioning in health care, i.e. route finding in an emergency evacuation of the hospital.<sup>3</sup>
- Compared the advantages/disadvantages of BLE, Wifi, and GPS.
- Used Swift for coding; Estimote and Beaconstac provide code samples for ease of use.
- Modeled Hospital entrance to identify specific regions that triggered specific actions when device was near.
  - Had to adjust output interval for the beacons to maintain accuracy

## METHODS (Cont.)

- Tested Estimote, exploring actions when activated by proximity.
  - Displayed PNG map of hospital using image display and changing object statuses.
  - Delivered sample gift store coupon using distinct storyboards.
    - Required intricate, obscure methods.
  - Redirected use to specific webpage using UIKit library.
- Tested Beaconstac, an alternative solution requiring minimal coding, but incapable of coordinate finding.
  - Actions only trigger via proximity, rather than coordinate finding.
- Analytics: Capable of tracking device location for data analysis on traffic flow, time spent at specific location, etc.

Researched SDK's, radio tech, and beacon tech

Developed proof of concept app using Estimote

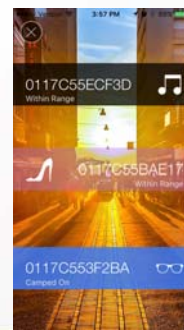
Mocked demo room, used proximity beacons.

Compared beacon systems and functionality

## DEMO



Custom Estimote sample app, displaying sample "gift coupon," trigger through Indoor Positioning



Standard Beaconstac sample app, listing three beacons at different states.

## RESULTS

- Proof of concept app was functional; successfully displayed a map image, "coupon" link, and webpage.
  - Demonstrates that beacons can trigger a wide variety of actions, with significant potential.
- Initial concerns addressed by altering settings; accuracy improved from reducing beacon intervals.
  - However, it seems to work better when in motion.
- Estimote proved more flexible; Beaconstac proved incredibly simple to deploy complete solution.
- Lack of current literature/research on Bluetooth in health care, despite Bluetooth's advantages, i.e. less energy usage, higher accuracy, ease of deployment.<sup>1</sup>

## CONCLUSIONS

- BLE offers potential for a wide variety of applications in health care, from information delivery to sanitary notifications. Use in way-finding seems to have potential.
- Estimote offers more potential functionality, whereas Beaconstac is simpler to deploy and includes better analytics.
- Bluetooth coding and app development could serve as an entry-level topic in programming using outside technology.
- Literature review supported belief that additional research should be explored in this area.

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