

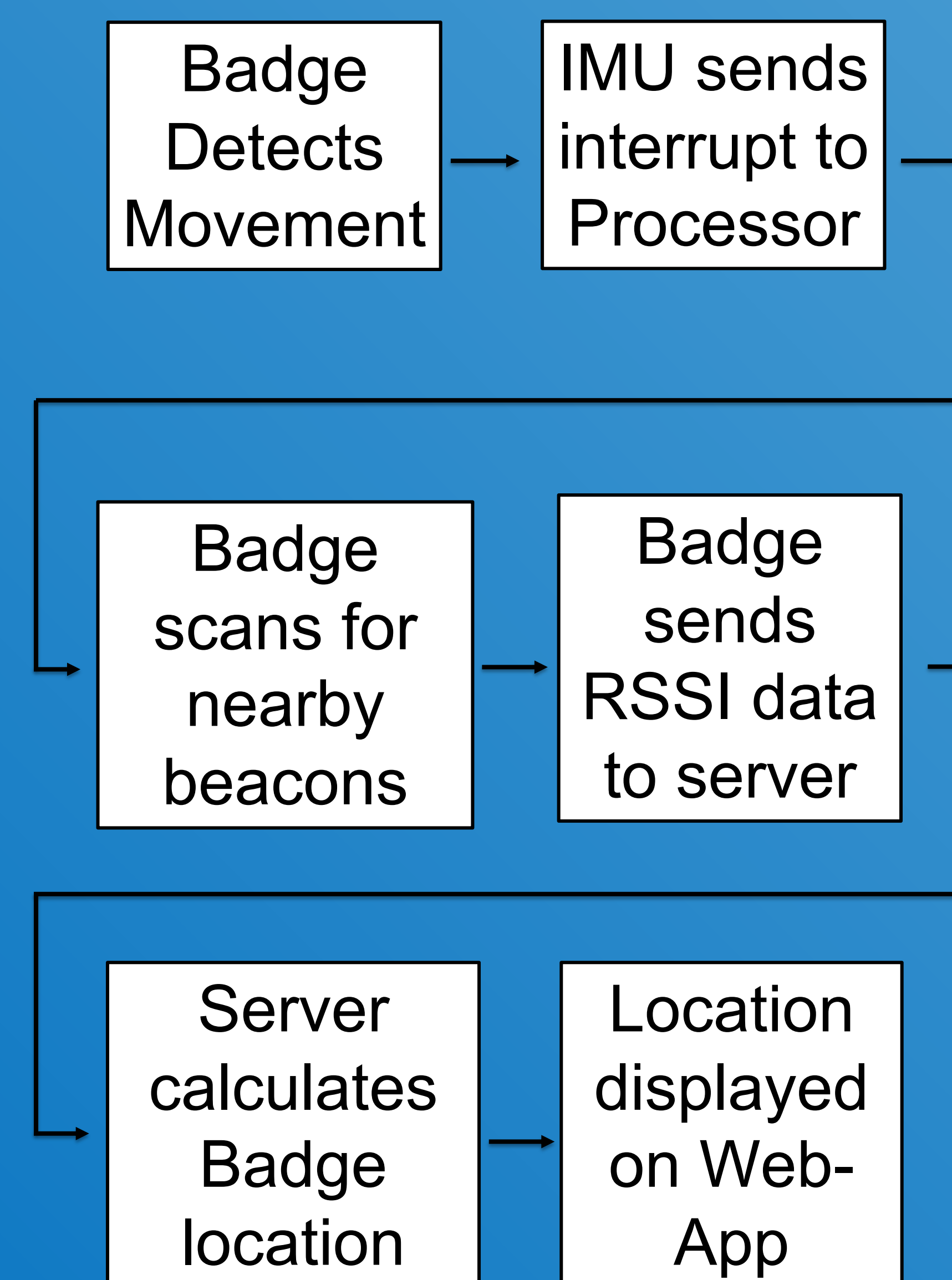
Background

Our goal is for hospitals to be able to record movement information about the doctors and nurses in the operating room. We do this by adding Bluetooth Low Energy chips into the employee's ID cards that help track location with the help of beacons placed in the rooms. This data then gets sent to a server via WiFi, where the employee's movement will be logged and displayed.

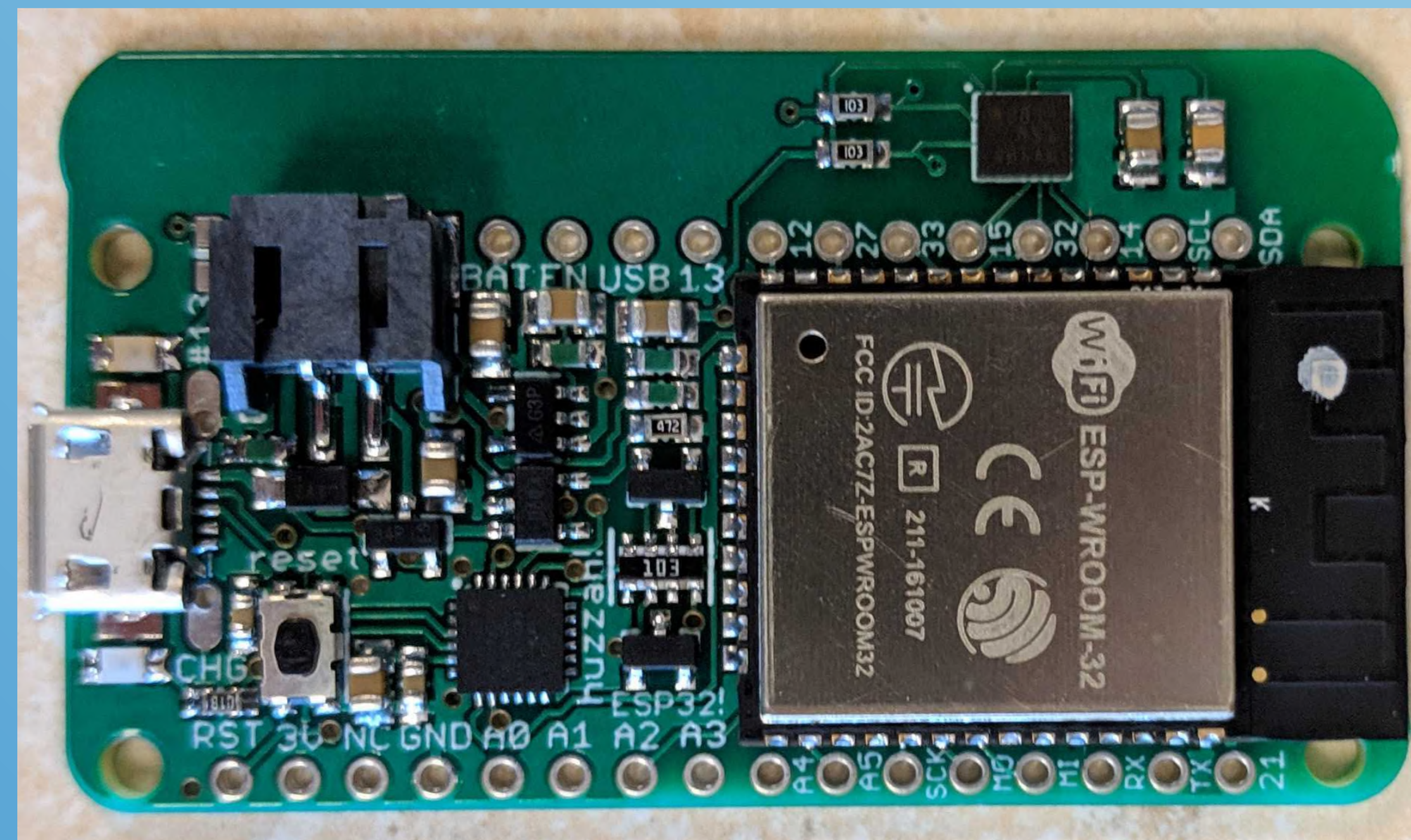
Overview

We designed the board by using a combination Bluetooth Low Energy Wi-Fi module as the base of our design, and an IMU to send interrupts on movement. The badge scans for Bluetooth beacons and records their received signal strength indicator (RSSI). This can be used to calculate distance from a beacon, and multiple distances can be used to triangulate position.

Functional Flow Diagram

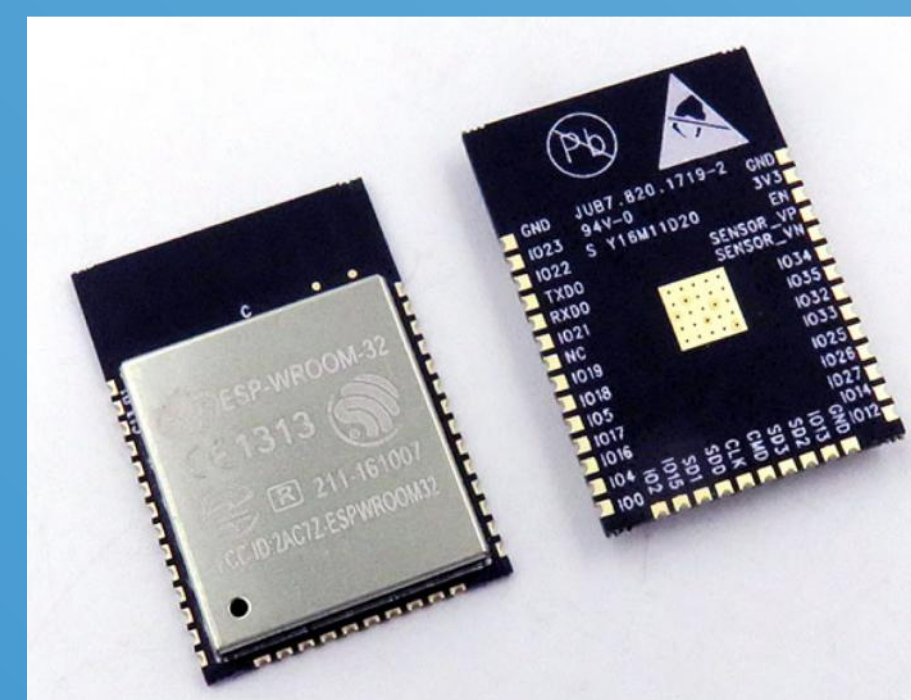


Printed Circuit Board



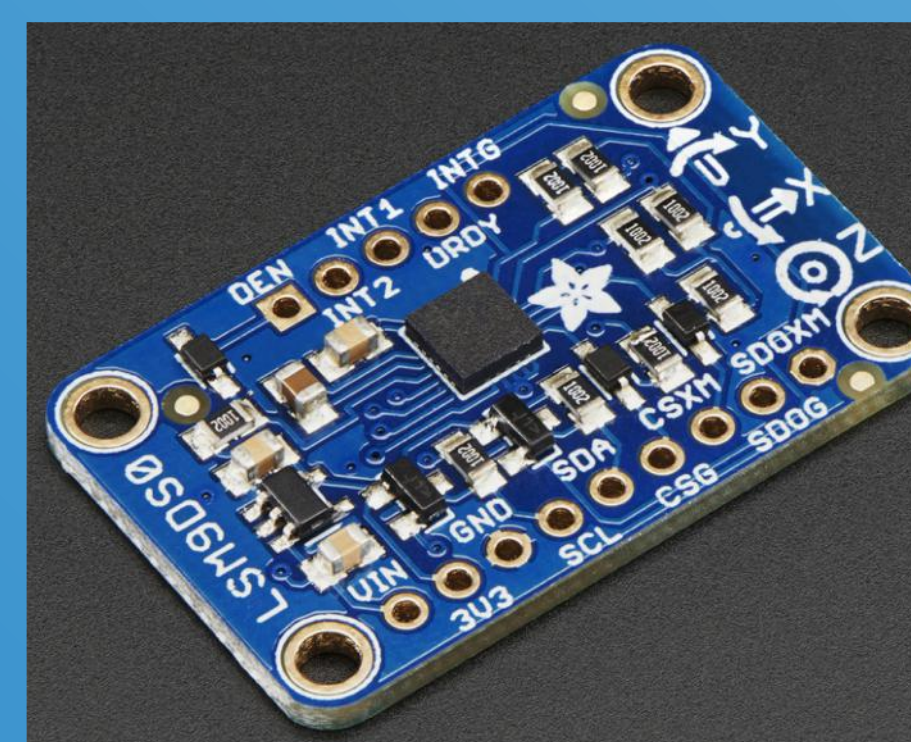
ESP32 system on chip with IMU located on the top of the PCB

Key Components



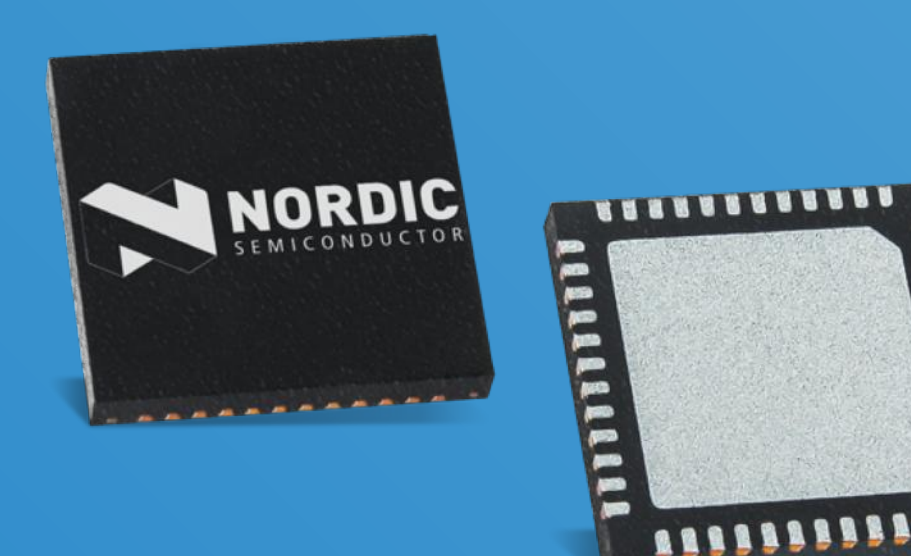
ESP32 BLE & Wi-Fi Module

- 32 bit microprocessor @160MHz
- Ultra low power co-processor for sleep @8MHz
- Dual core



IMU: LSM9DS1

- Contains a gyroscope, accelerometer, and magnetometer
- 9 degrees of freedom
- 15mA max current draw



Bluetooth beacon: Nordic nRF52

- BLE compatible 2.4GHz radio
- USB serial converter for fast programming/debugging

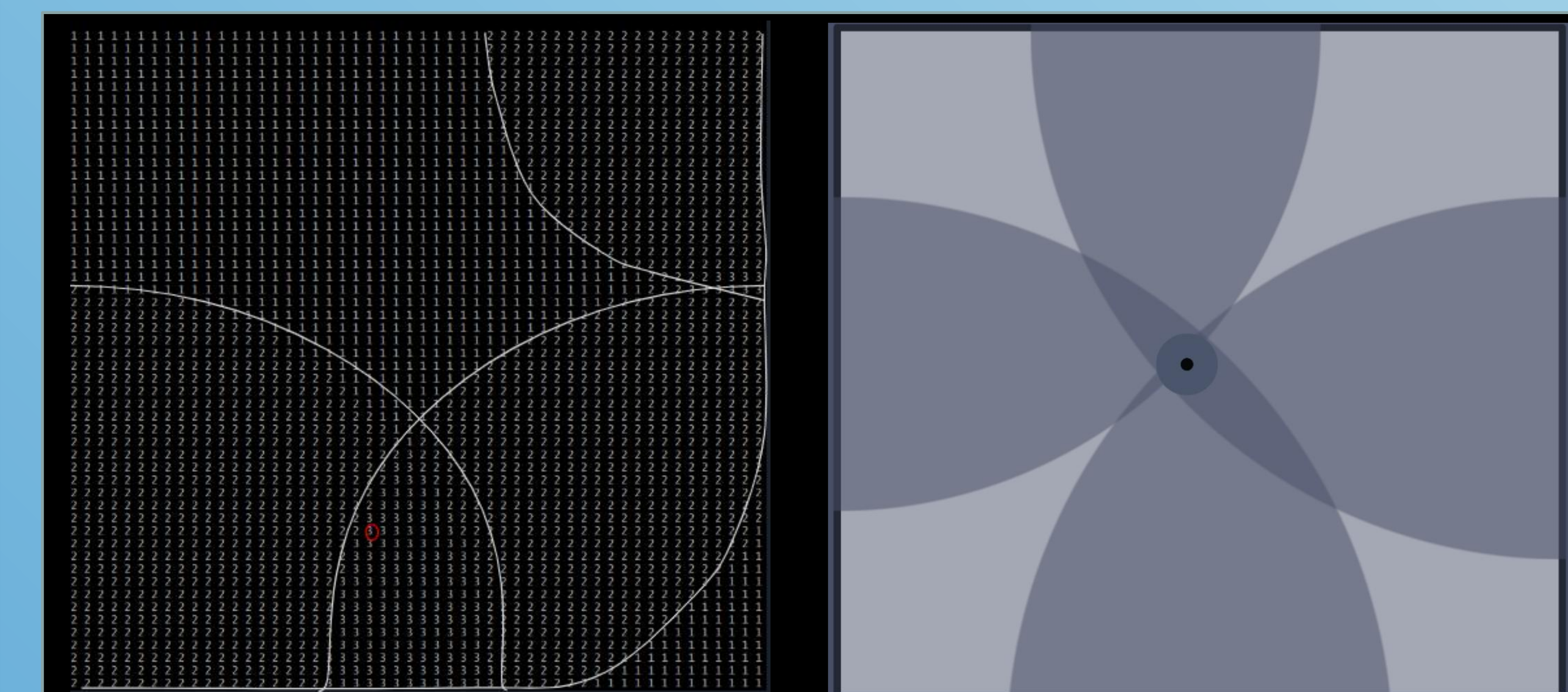
Final Product



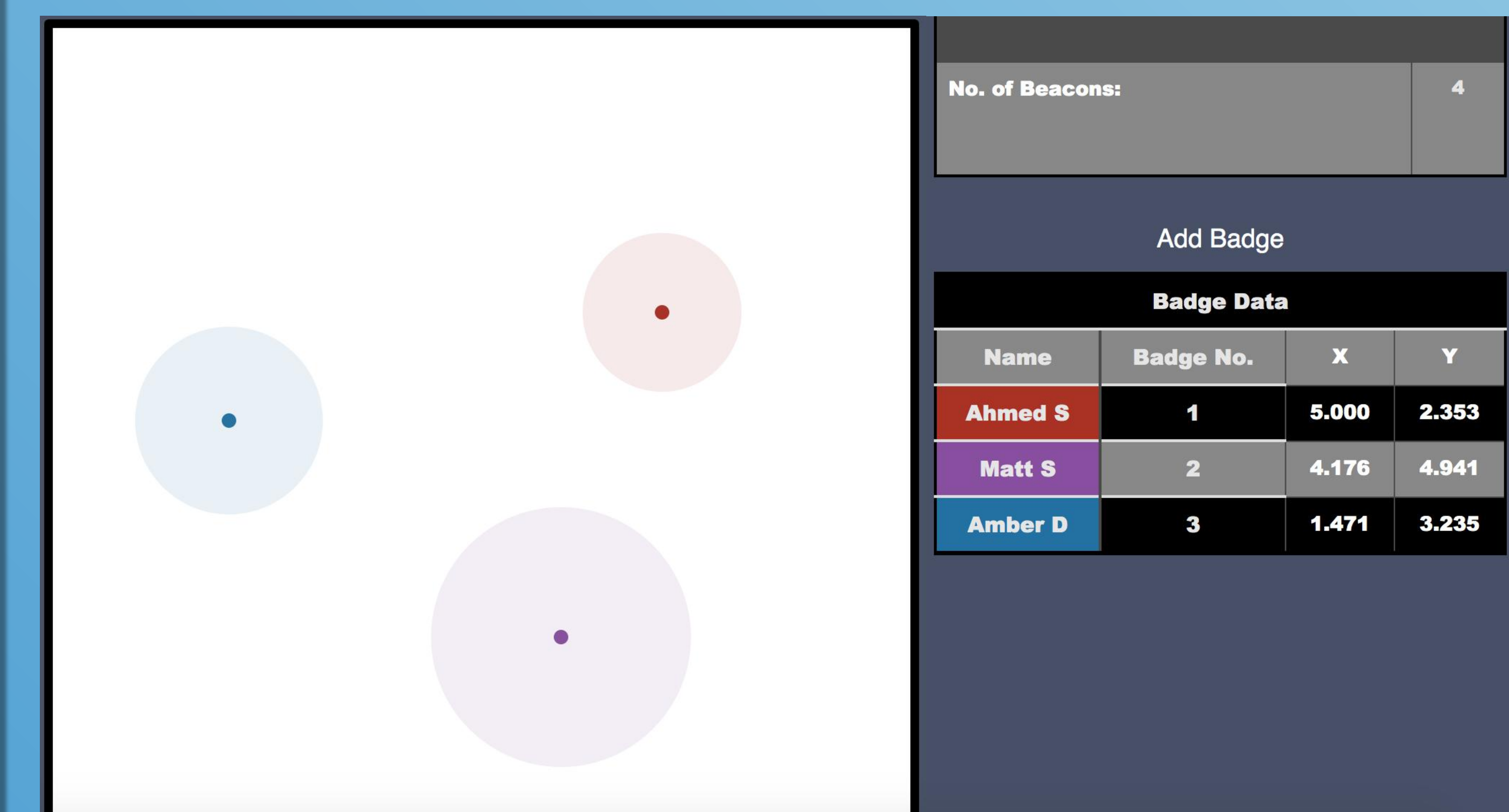
A look at internals of a BLIPS badge

Specifications

Length: 93.5mm
Width: 58mm
Thickness: 14.4mm
Weight: 76.6g



Two different representations of location calculations performed by badge (Left) and server (Right)



An example of the Web-App display window