



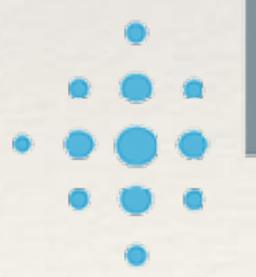
 Bluetooth®



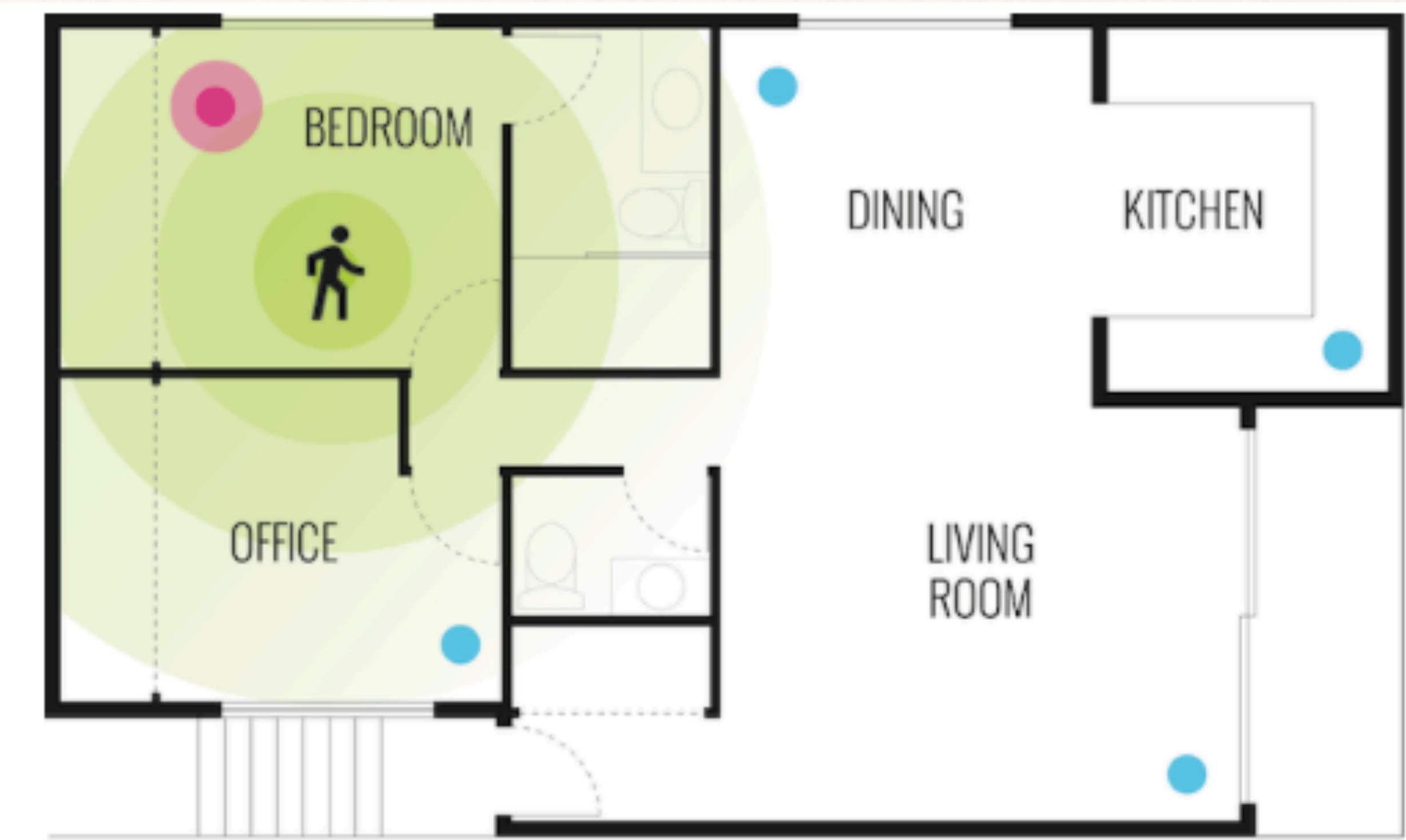
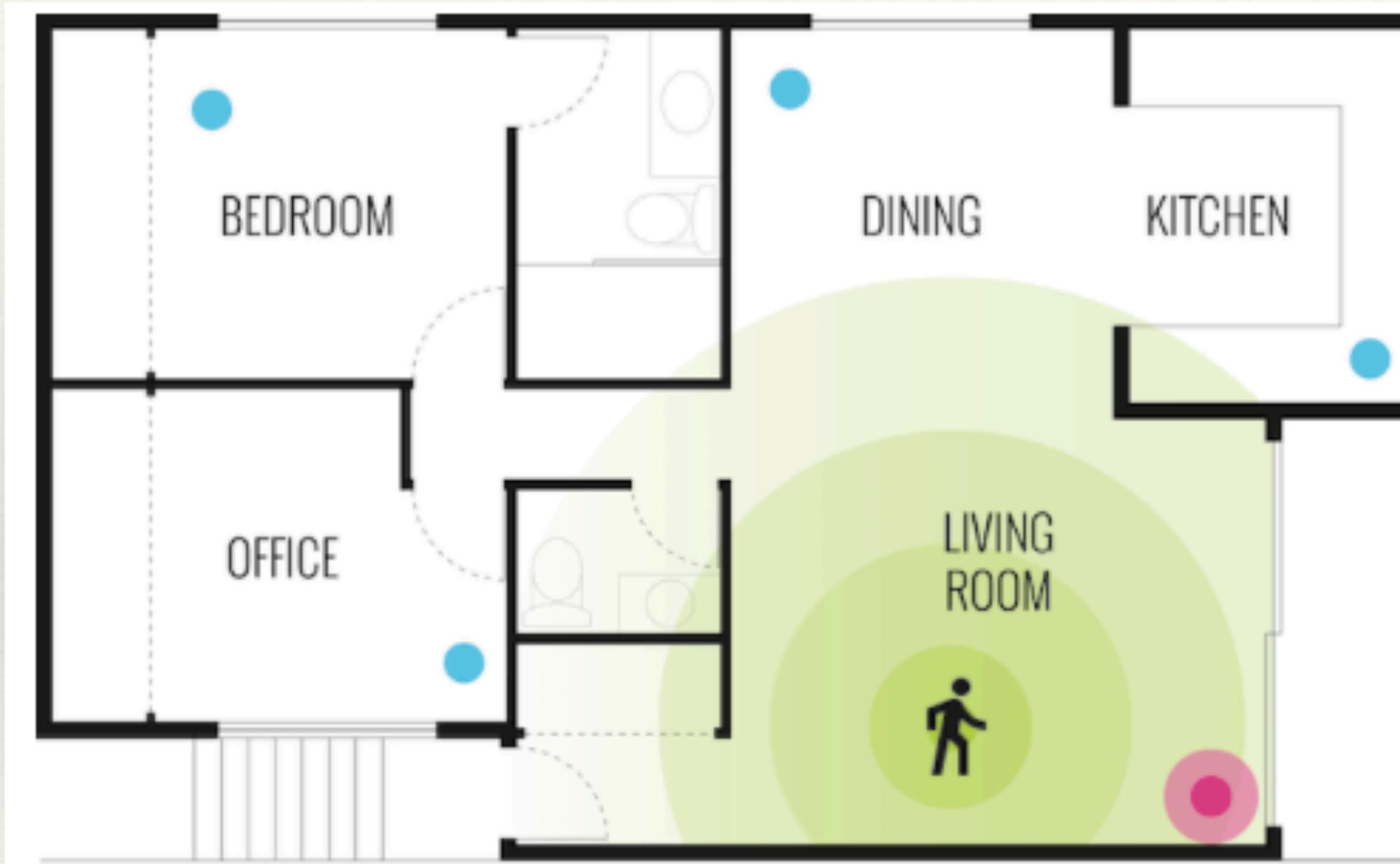
*Materialien im Krankenhaus wiederfinden*

*Adam Mechouate*

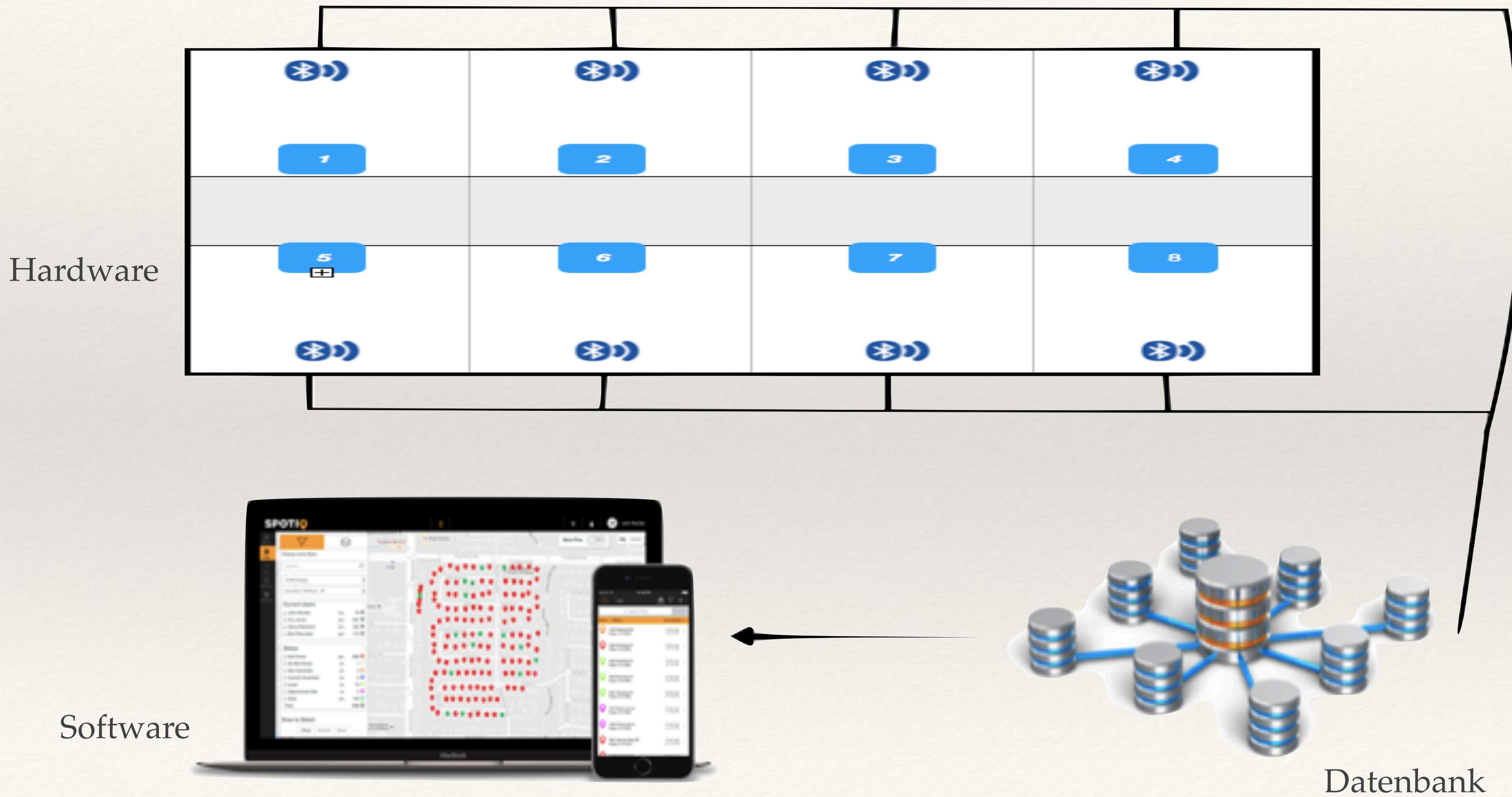
# Hospittracking

 **hospicall**  
Rufsysteme

# Wie funktioniert das ?



# Wie funktioniert das ?



# Materialien im Krankenhaus wiederfinden !

- ❖ Was brauchen wir dafür ?



Small, configurable, long-lasting, Bluetooth LE beacon

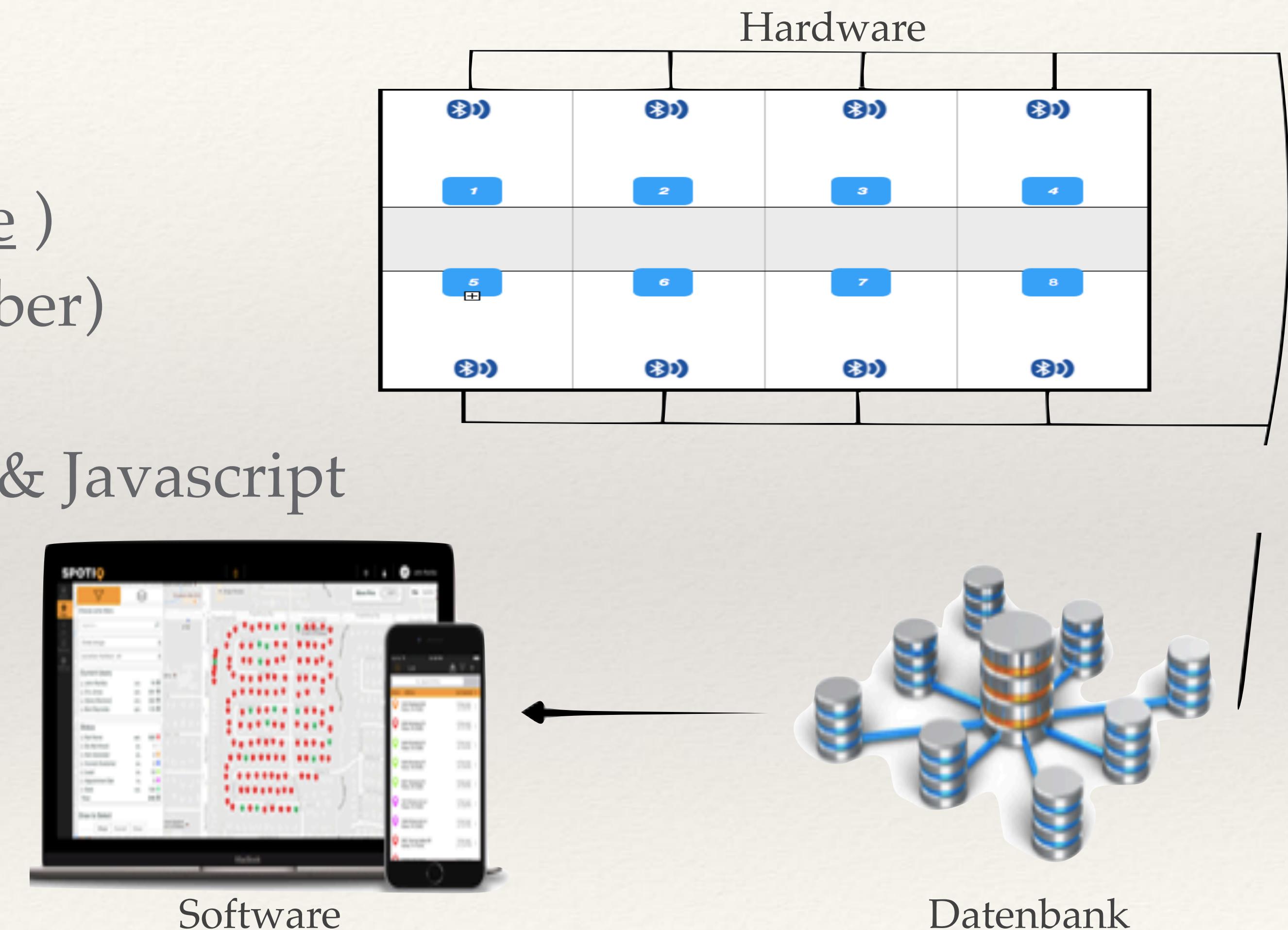


Bluetooth-detecting, wifi-connecting presence detector

# Softwareentwicklung

- ❖ Datenbank My SQL ( [open-source](#) )
- ❖ MQTT server (Publisher/Subscriber)
  - ❖ Mosquitto
- ❖ Webbasierte Anwendung HTML & Javascript

- ❖ Facultatif
- ❖ (Mobile App Android Studio)



# Bluetooth is Changing the Face of Healthcare



- ❖ Today's consumers want to control and manage their own health, and a standardized wireless approach for communication between devices gives them that ability. Just about every new health tracking platform—including Apple HealthKit and Google Fit—uses Bluetooth to ensure device and data interoperability.



# Bluetooth is the ideal wireless standard for hospital



- ❖ Bluetooth with low energy offers highly secure 128-bit AES encryption to keep data safe during transmission. Privacy features also make it difficult to track a device through its Bluetooth connection. All of this keeps the user in control.
- ❖ The frequency-hopping Bluetooth radio virtually eliminates network interference and provides strong immunity to RF noise sources such as electrosurgical devices and common household appliances.



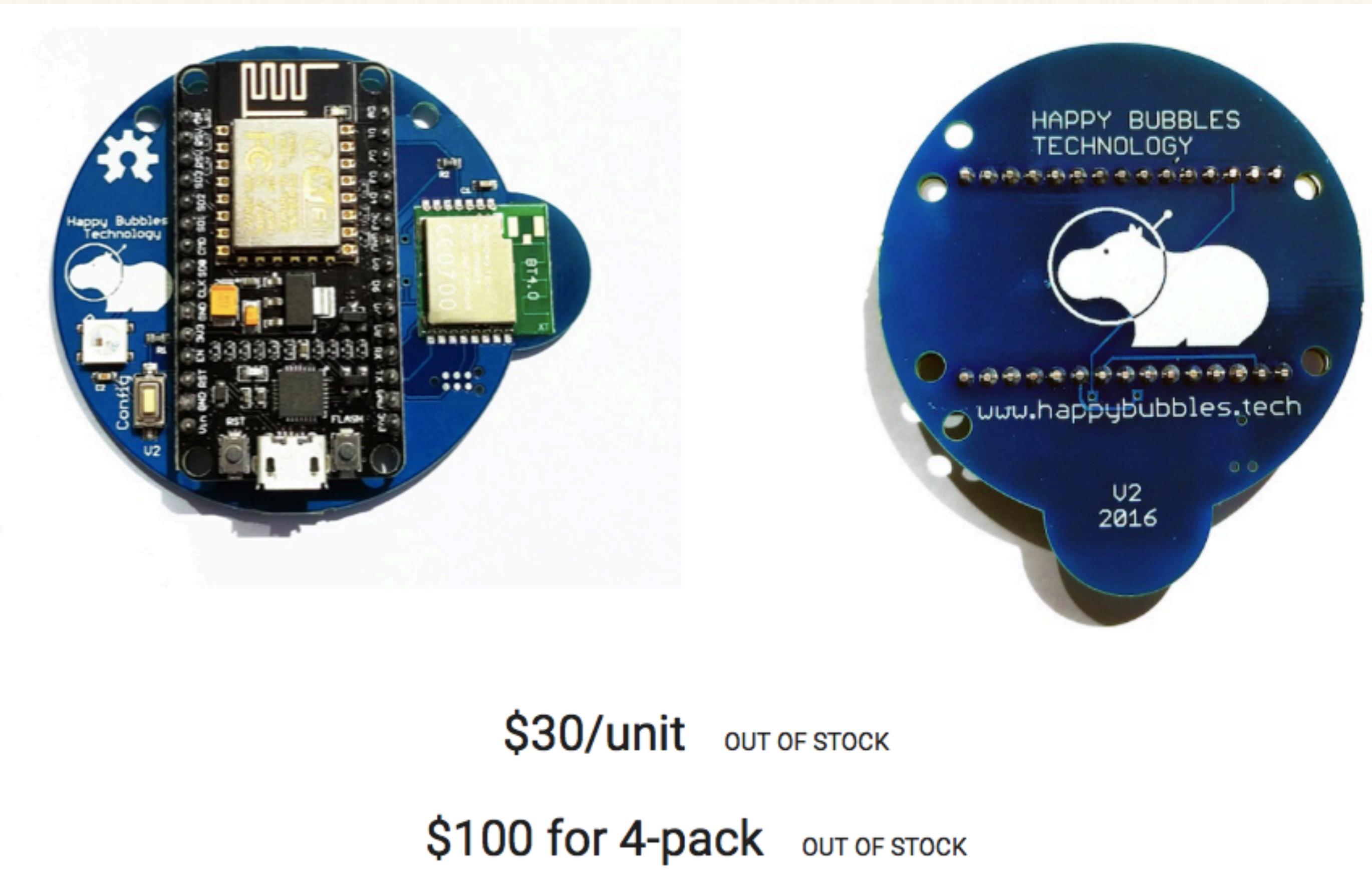
# Bluetooth enabled medical devices are changing the way we take care of ourselves



- ❖ Secure, trusted and super-efficient Bluetooth technology is enabling the connectivity of millions of health and medical devices, with tens of millions more on the way.
- ❖ An apple a day is no longer enough to keep the doctor away. Now, patients can help keep themselves healthy using a wide range of medical devices—all connected via Bluetooth technology.

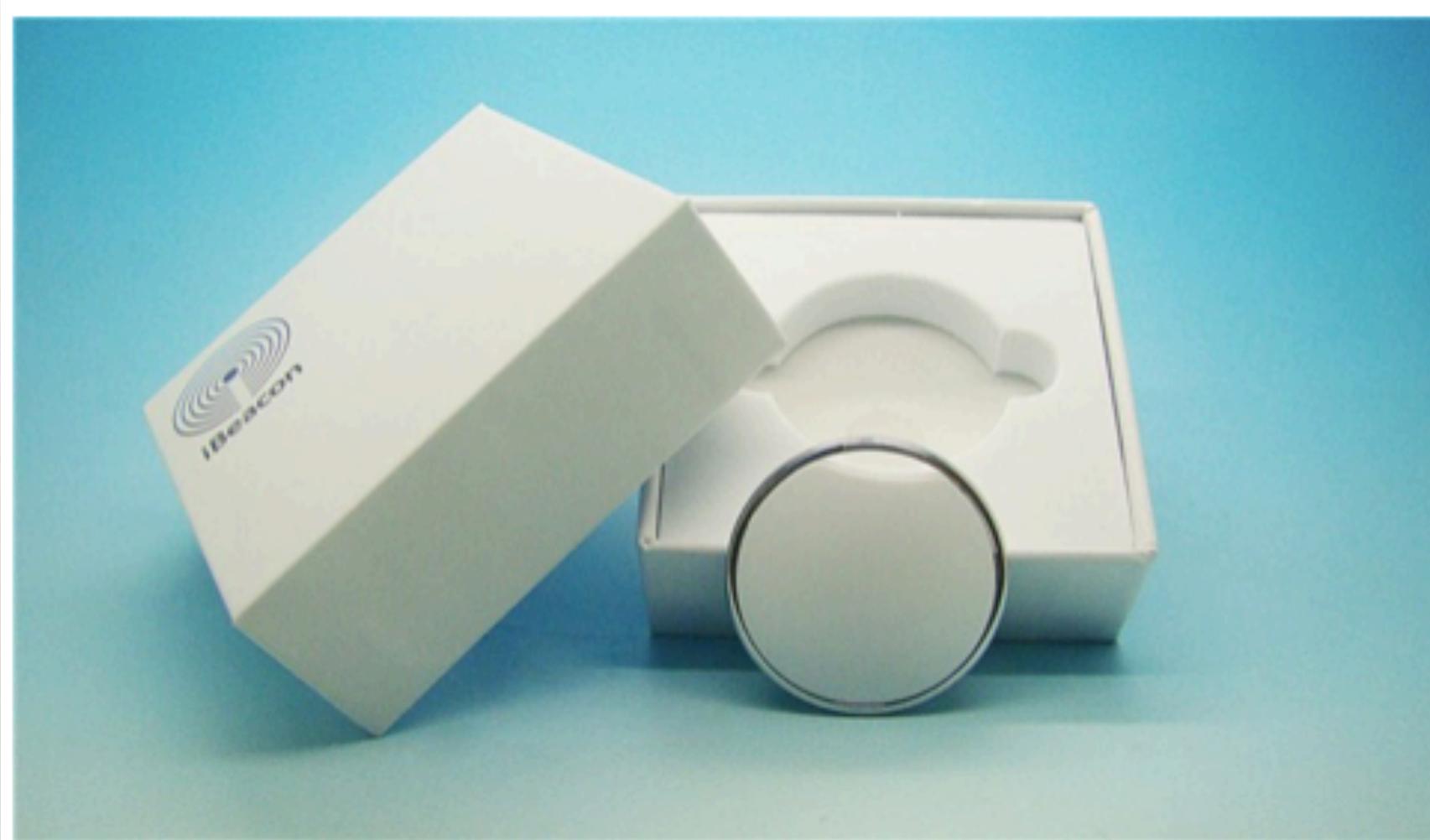


# Hardware kosten Happy Bubbles presence detectors



Happy Bubbles Technology

## Hardware kosten iBeacon

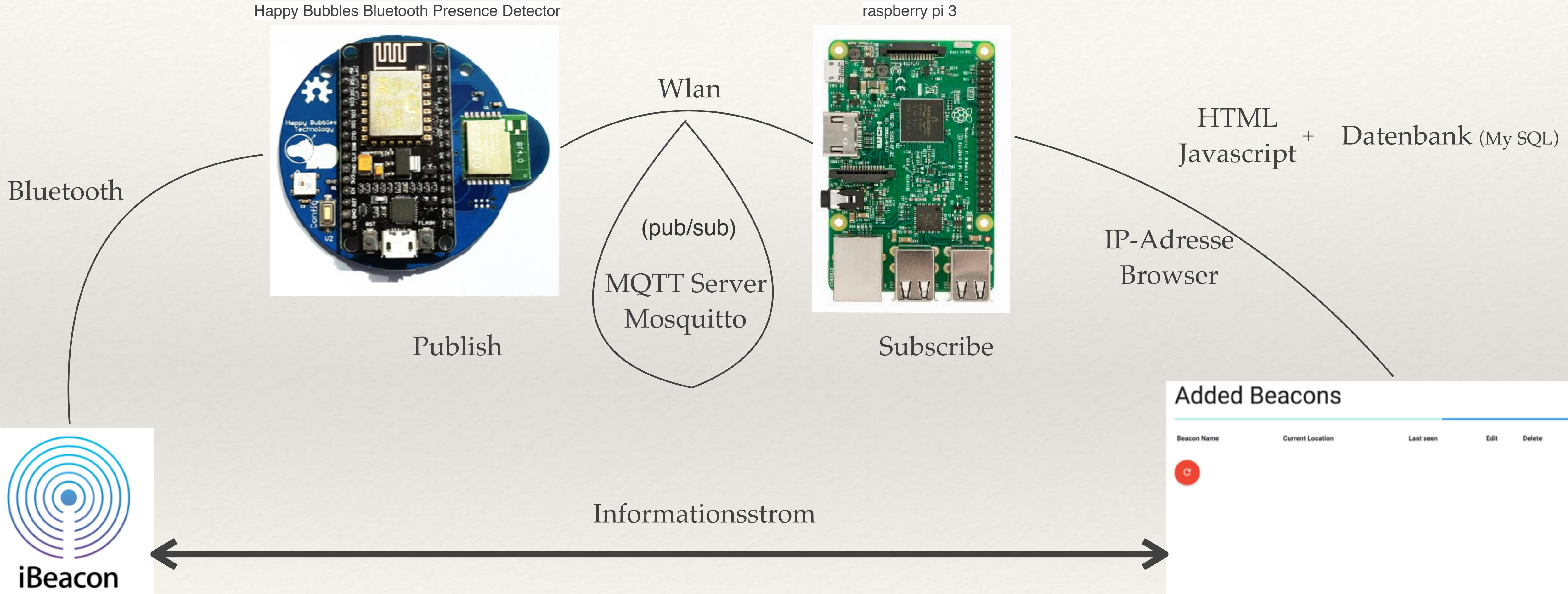


\$15/unit

ADD TO CART

Bluetooth Low Energy beacon

# Technical

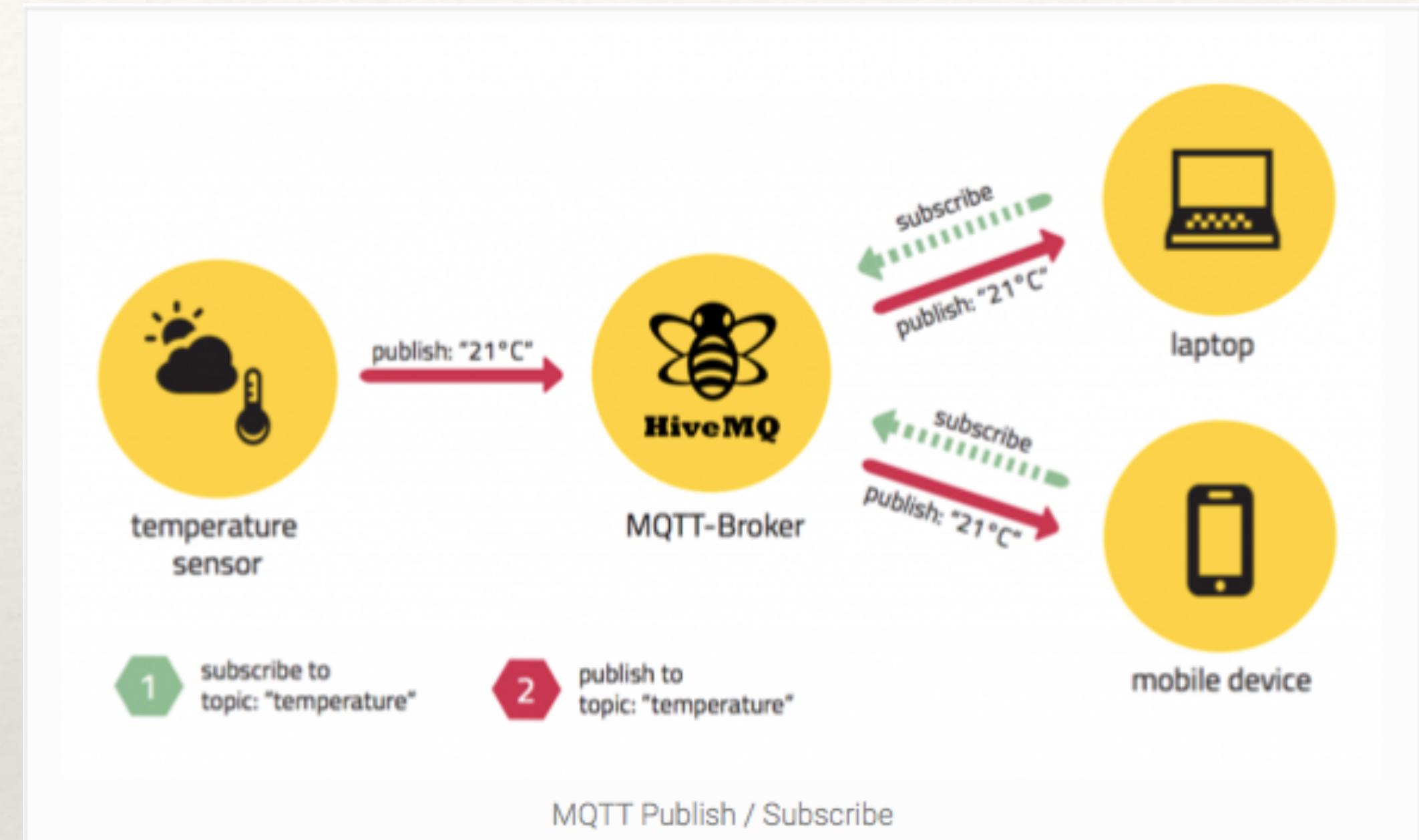


# MQTT: Publish & Subscribe

As already mentioned the main aspect in pub/sub is the decoupling of publisher and receiver, which can be differentiated in more dimensions:

- Space decoupling: Publisher and subscriber do not need to know each other (by ip address and port for example)
- Time decoupling: Publisher and subscriber do not need to run at the same time.
- Synchronization decoupling: Operations on both components are not halted during publish or receiving

The decoupling has three dimensions: Space, Time, Synchronization.



# Algorithmus: Message Filtering



The filtering is based on a subject, which is part of each message.

- Der Median, ersten und dritten Quartil und dadurch der Annahmebereich werden jede minute gerechnet oder erst wenn drei nacheinander Mittelwerten nicht zum Annahmebereich gehören.
- Der Median
- Ersten Quartil
- Dritten Quartil
- Annahmebereich
- Mittelwerten (von wieviel werten ?)

```
9 #include <stdio.h>
10 int main(int argc, const char * argv[]) {
11     // Der Mittelwert
12     int i;
13     int T[10]={5,7,11,9,12,6,9,8,6,13};
14     float mw=T[0];
15     for (i=1;i<10;i++) {
16         mw+=T[i];
17     } // trie du tableau! /* Déclarations */
18     int I;
19     int J;
20     int AIDE; /* pour la permutation */
21     int FIN; /* position où la dernière permutation a eu lieu. */
22     /* dimension */ /* rang à partir duquel A est trié *//* indice courant */
23     /* permet de ne pas trier un sous-ensemble déjà trié. *//* Affichage du tableau */
24     printf("Tableau donné :\n");
25     for (i=0; i<10; i++)
26         printf("%d ", T[i]);
27     printf("\r");
28     printf(" Der Mittelwert beträgt = %.2f \n",mw/10);
29     /* Tri du tableau par propagation de l'élément maximal. */
30     for (I=9 ; I>0 ; I--FIN)
31     {
32         FIN=0;
33         for (J=0; J<I; J++)
34             if (T[J]>T[J+1])
35             {
36                 FIN=J;
37                 AIDE=T[J];
38                 T[J]=T[J+1];
39                 T[J+1]=AIDE;
40             }
41         // Edition du résultat
42         printf("Tableau trié :\n");
43         for (i=0; i<10; i++)
44             printf("%d ", T[i]);
45         printf("\r");
46         // calcule de la Mediane
47         float md=(T[4]+T[5]);
48         printf("La mediane est : %.2f \n",md/2);
49         //ersten Quartil Q1
50         printf("Tableau donné :\n");
51         for (i=0; i<5; i++)
52             printf("%d ", T[i]);
53         printf("\r");
54         printf(" Der ersten Quartil beträgt = %d \n",T[2]);
55         // dritten Quartil Q3
56         printf("Tableau donné :\n");
57         for (i=5; i<10; i++)
58             printf("%d ", T[i]);
59         printf("\r");
60         printf(" Der dritten Quartil beträgt = %d \n",T[7]);
61         // Annahme bereich !
62         printf(" der Annahmebereich liegt zwischen [%d;%d] \n",T[2],T[7]);
```

# Bibliographie & Webographie



- ❖ <https://www.happybubbles.tech/presence/detector>
- ❖ <https://www.happybubbles.tech/presence/beacon>
- ❖ [https://minew.en.alibaba.com/product/60377700306-220649015/Bluetooth\\_nRF51822\\_iBeacon\\_Protable\\_UFO\\_Beacon\\_ibeacon\\_tag.html](https://minew.en.alibaba.com/product/60377700306-220649015/Bluetooth_nRF51822_iBeacon_Protable_UFO_Beacon_ibeacon_tag.html)
- ❖ [https://wholesaler.alibaba.com/product-detail/BLE-Finder-Key-Locator-APP\\_60703721374.html](https://wholesaler.alibaba.com/product-detail/BLE-Finder-Key-Locator-APP_60703721374.html)
- ❖ [https://minew.en.alibaba.com/product/60705123893-220649015/Nordic\\_nRF52832\\_Wide\\_Range\\_Beacon.html?spm=a2700.8304367.rect38f22d.3.76c543e4qUS8Z0](https://minew.en.alibaba.com/product/60705123893-220649015/Nordic_nRF52832_Wide_Range_Beacon.html?spm=a2700.8304367.rect38f22d.3.76c543e4qUS8Z0)
- ❖ [https://minew.en.alibaba.com/product/60704730807-220649015/multi\\_protocol\\_programmable\\_beacon\\_with\\_iBeacon\\_Eddystone.html?spm=a2700.8304367.rect38f22d.9.57d7d268iFy3Qf](https://minew.en.alibaba.com/product/60704730807-220649015/multi_protocol_programmable_beacon_with_iBeacon_Eddystone.html?spm=a2700.8304367.rect38f22d.9.57d7d268iFy3Qf)



# Danke für Ihre Aufmerksamkeit

**Bluetooth®**

the global wireless standard for simple, secure connectivity.

Bluetooth® Basic Rate/  
Enhanced Data Rate (BR/EDR)  
for continuous connections

Bluetooth® Low Energy (LE)  
for short burst connections

**point-to-point (1:1)**

- audio streaming
  - wireless headsets
  - wireless speakers
  - in-car audio

**point-to-point (1:1)**

- data transfer
  - sports & fitness devices
  - health & wellness devices
  - peripherals & accessories

**broadcast (1:m)**

- localized information
  - point of interest beacons
  - item finding beacons
  - way finding beacons

**mesh (m:m)**

- large device networks
  - building automation
  - wireless sensor networks
  - asset tracking