Bluetooth®

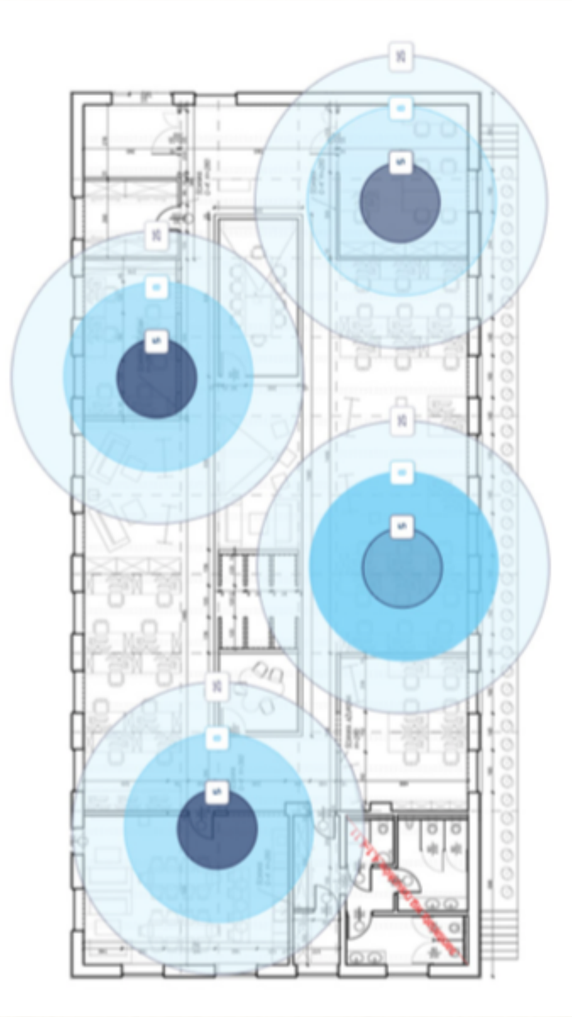
Materialien im Krankenhaus wiederfinden *Adam Mechouate*

Hospitracking

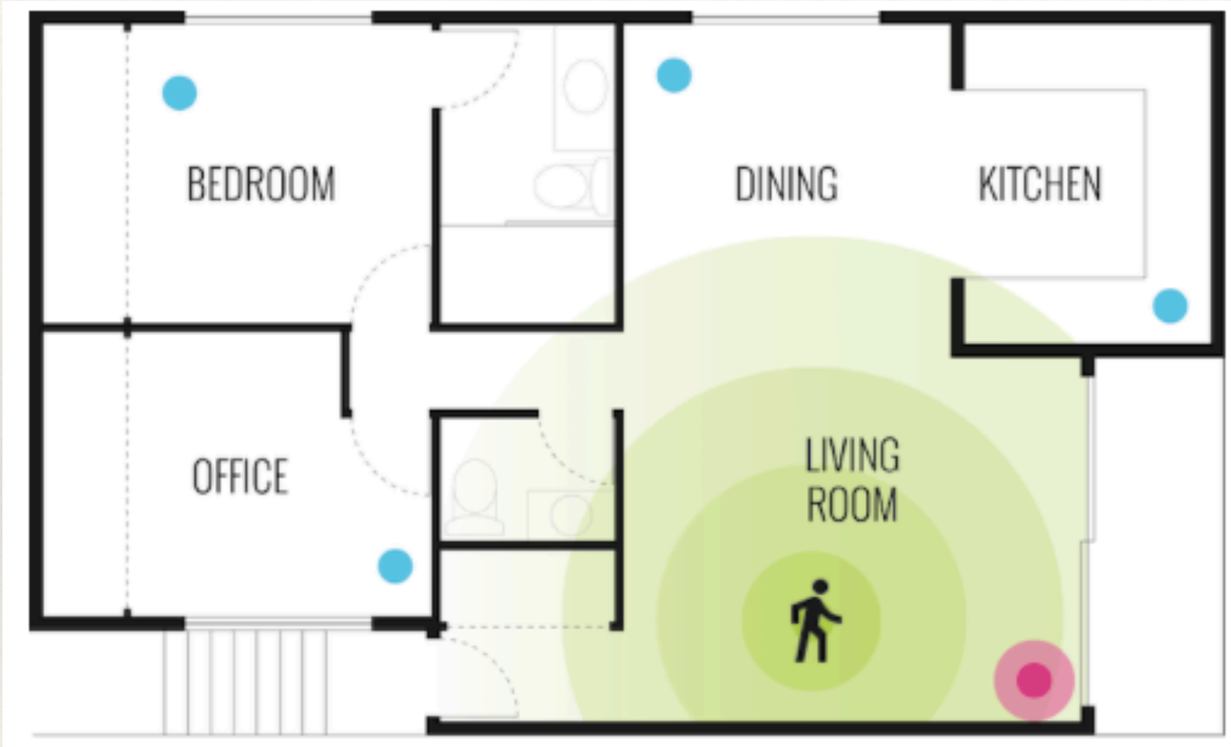
hospicall Rufsysteme

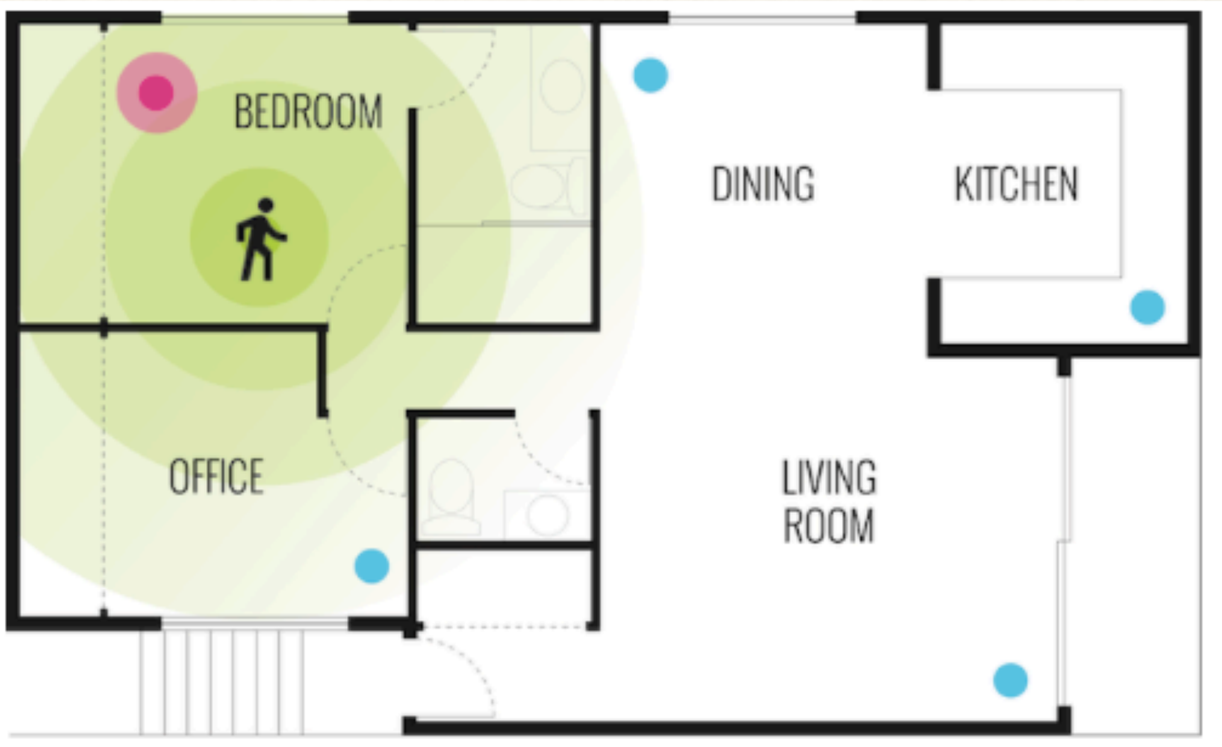
Real Time Location Systems

- Comparing RTLS infrastructure: (Hardware)
  - Alle Technologie (RTLS)
    - Wlan RTLS (Power-hungry)
    - Ultra wide-Band RTLS (less than a meter)
    - Passive RFID (ca. 20 cm, veraltete technologie)
    - Bluetooth Low Energy (BLE)



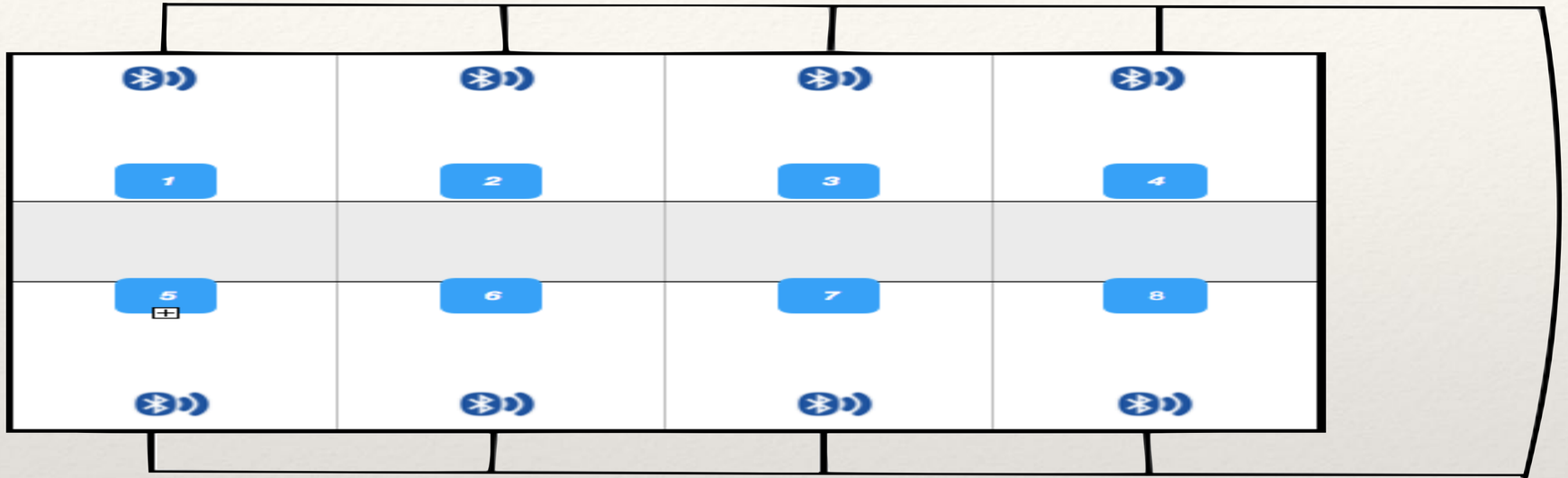
Wie funktioniert das ?





Wie funktioniert das ?

Hardware



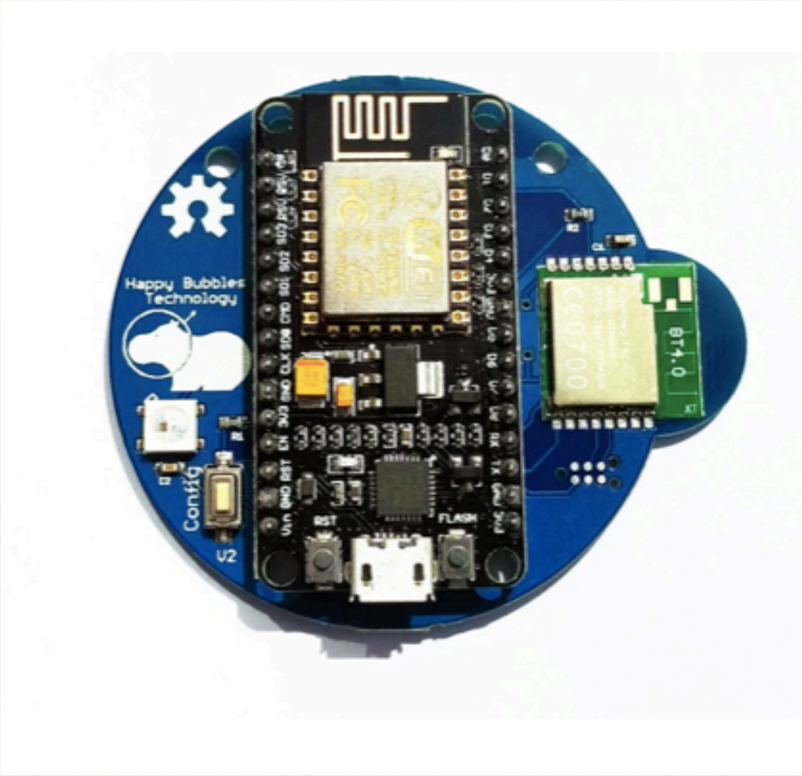
Software

Datenbank

Materialien im Krankenhaus wiederfinden !

- Was brauchen wir dafür ?

Small, configurable, long-lasting, Bluetooth LE beacon



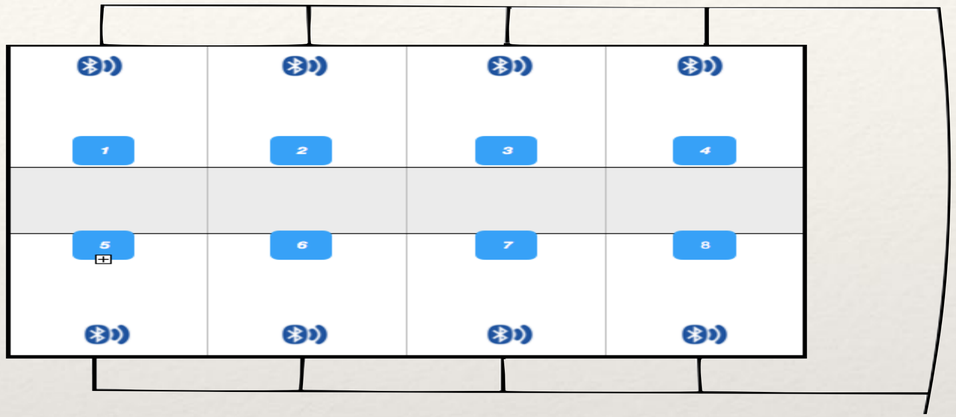
Bluetooth-detecting, wifi-connecting presence detector

Softwareentwicklung

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

- Facultatif
- (Mobile App Android Studio)

Hardware



Software

Datenbank

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

hospicall Rufsysteme

- 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

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- 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

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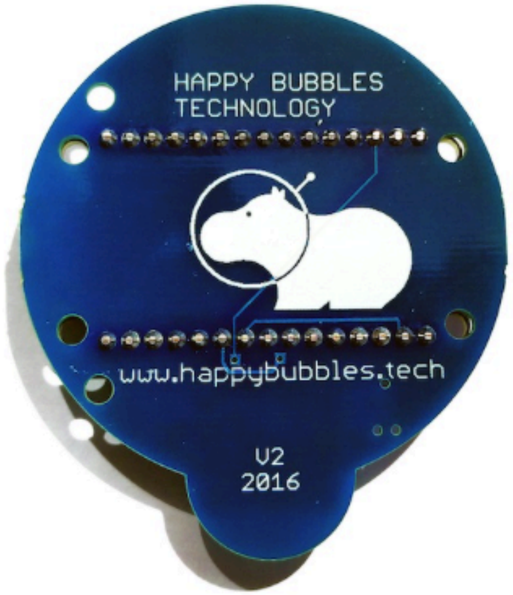


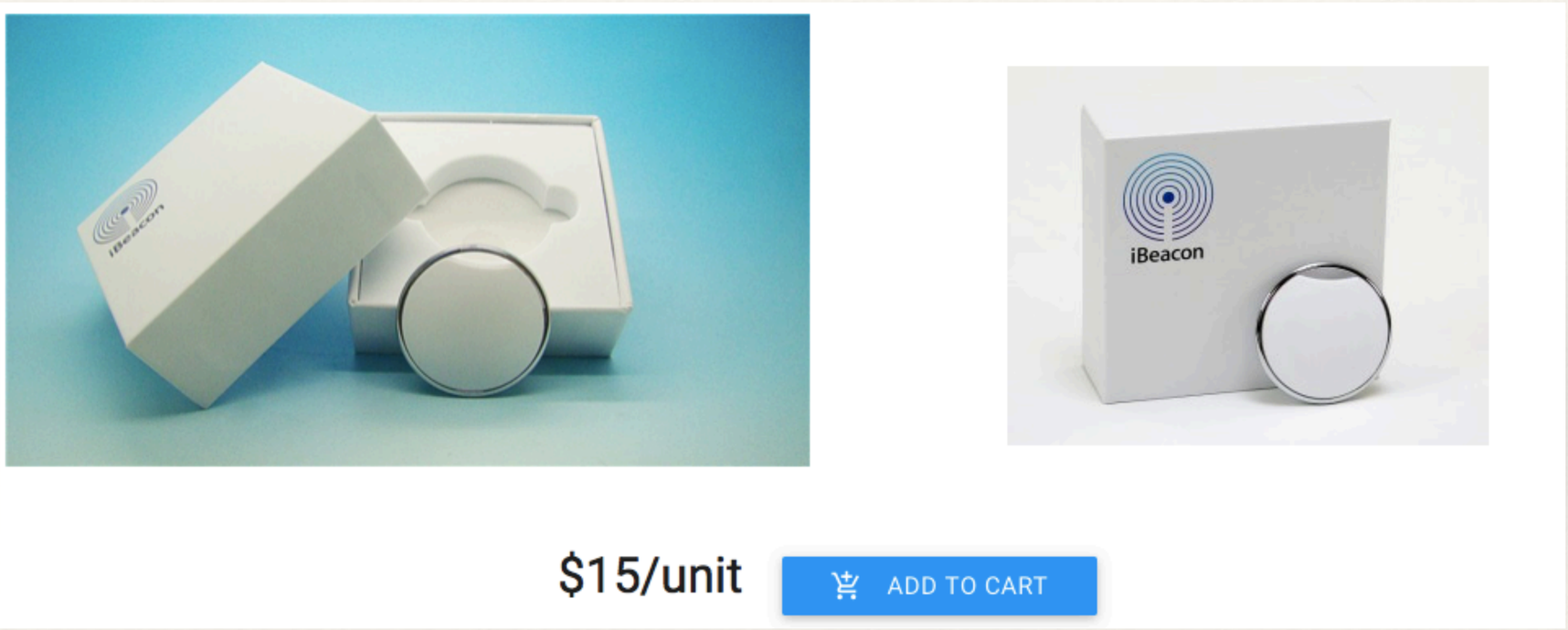
$30/unit OUT OF STOCK

$100 for 4-pack OUT OF STOCK

Happy Bubbles Technology

Hardware kosten
iBeacon

hospicall Rufsystème



Bluetooth Low Energy beacon

Technical

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Happy Bubbles Bluetooth Presence Detector

raspberry pi 3

Wlan

(pub/sub)

MQTT Server
Mosquitto

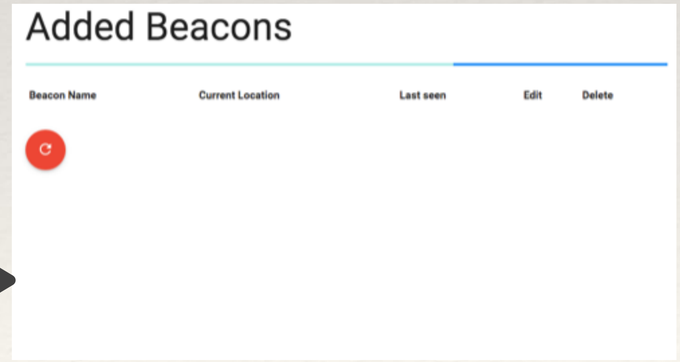
Bluetooth

Publish

Subscribe

HTML
Javascript + Datenbank (My SQL)

IP-Adresse
Browser



iBeacon

Informationsstrom

MQTT: Publish & Subscribe

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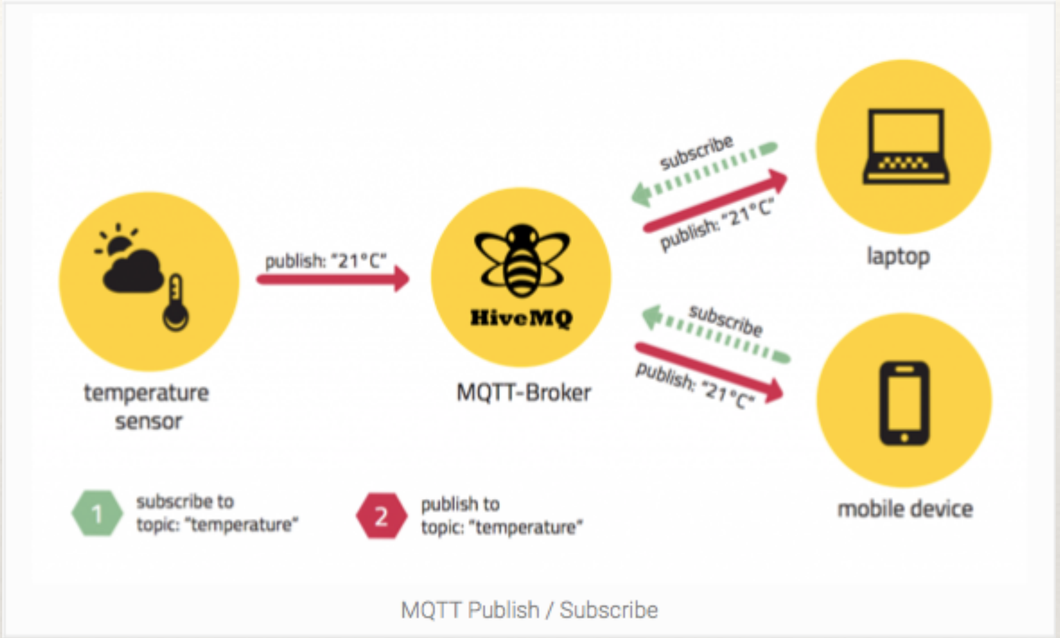
As already mentioned the main aspect in pub/sub is the decoupling of publisher and receiver, which can be differentiated in more dimensions:

- 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.



MQTT Publish / Subscribe

Algorithmus: Message Filtering

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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 (über 10 Werte!)

```c
#include <stdio.h>
int main(int argc, const char * argv[]) {
    // Der Mittelwert
    int i;
    int T[10]={5,7,11,9,12,6,9,8,6,13};
    float mw=T[0];
    for (i=1;i<13;i++) {
        mw+=T[i];
    } // trie du tabelle! /* Déclarations */
   int I;
   int J;
   int AIDE; /* pour la permutation */
   int FIN; /* position où la dernière permutation a eu lieu. */
    /* dimension     */ /* rang à partir duquel A est trié *//* indice courant  */
    /* permet de ne pas trier un sous-ensemble déjà trié. *//* Affichage du tableau */
    printf("Tableau donné :\n");
    for (i=0; i<10; i++)
        printf("%d ", T[i]);
    printf("\n");
    printf(" Der Mitelwert beträgt = %.2f \n',mw/13);
    /* Tri du tableau par propagation de l'élément maximal. */
    for (I=9 ; I>0 ; I=FIN)
    {
        FIN=0;
        for (J=0; J<I; J++)
            if (T[J]>T[J+1])
            {
                FIN=J;
                AIDE=T[J];
                T[J]=T[J+1];
                T[J+1]=AIDE;
            } }
    // Edition du résultat
    printf("Tableau trié :\n");
    for (i=0; i<10; i++)
        printf("%d ", T[i]);
    printf("\n");
    // calcule de la Mediane
    float md=(T[4]+T[5]);
    printf("la mediane est : %.2f \n",md/2);
    //ersten Quartil Q1
    printf("Tableau donné :\n");
    for (i=0; i<5; i++)
        printf("%d ", T[i]);
    printf("\n");
    printf(" Der ersten Quartil beträgt = %d \n",T[2]);
    // critten Quartil Q3
    printf("Tableau donné :\n");
    for (i=5; i<10; i++)
        printf("%d ", T[i]);
    printf("\n");
    printf(" Der dritten Quartil beträgt = %d \n",T[7]);
    // Annahme bereich !
    printf(" der Annahmebereich liegt zwischen  [%d;%d] \n",T[2],T[7]);
```

Bibliographie & Webographie

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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