

|  |  |
| --- | --- |
|  | Smart Refrigerator  *The first device of the smart kitchen - Seesam* |
|  | Tom Mampaey &  Bernd Verhofstadt  Bachelor Electronics – ICT  Erasmusstudents: Belgium  OAMK - University of Applied Sciences  Jan – May 2015 |

Table of contents:

[1. Introduction: 2](#_Toc409601775)

[2. The project: 2](#_Toc409601776)

[3. Github: 2](#_Toc409601777)

[4. The idea’s and brainstorm: 3](#_Toc409601778)

[- User recognition: 3](#_Toc409601779)

[o **Fingerprint reader in handheld:** 3](#_Toc409601780)

[o **Active RFID key-hanger or card:** 3](#_Toc409601781)

[o **Kinect face-recognition:** 3](#_Toc409601782)

[o **Face-recognition Raspberry-Pi:** 3](#_Toc409601783)

[o **Voice-recognition:** 3](#_Toc409601784)

[o **Motion-detection:** 3](#_Toc409601785)

[- Product recognition and recommendation: 4](#_Toc409601786)

[o **Barcode-reader:** 4](#_Toc409601787)

[o **NFC-tag:** 4](#_Toc409601788)

[o **Mechanical detection/hatches:** 4](#_Toc409601789)

[o **LED’s/ LED-strip** 4](#_Toc409601790)

[- Health-detection: 5](#_Toc409601791)

[o **Integrated scale:** 5](#_Toc409601792)

[o **Personal point-system (based on earlier snacks):** 5](#_Toc409601793)

[o **BMI-calculator:** 5](#_Toc409601794)

[- Communication/Platform: 5](#_Toc409601795)

[o **Raspberry Pi:** 5](#_Toc409601796)

[o **Arduino:** 5](#_Toc409601797)

[o **Wi-Fi and Ethernet (LAN):** 5](#_Toc409601798)

[o **Bluetooth:** 5](#_Toc409601799)

[5. Estimated Gantt-chart: 6](#_Toc409601800)

[The Annex: 8](#_Toc409601801)

[Content: 8](#_Toc409601802)

[Images: 8](#_Toc409601803)

# Introduction

We are both third-year students from ‘Artesis Plantijn Antwerp’ in Belgium. When we saw the opportunity to go on Erasmus to Oulu in Finland and do our Bachelor-project there we did everything to make it possible.   
Here we are, and we are very thrilled about the project we finally got!

# The project

The project we are doing is a daughter-project of a bigger project of two years to put some intelligence into the ordinary kitchen (Seesam). We have the privilege to be the first two students to contribute to this project.

As stated in the title, we will delve us into the smart refrigerator!  
Wouldn’t be awesome if your refrigerator knew more about you, your habits and products?  
Well, that’s exactly what we will make for you!  
  
The main idea is to make a refrigerator that will know who’s using it, what he may and what he may not eat and even what’s in the refrigerator. The refrigerator will know this based on the current properties of the user (User-input, Readers, BMI-calculator,…).

# Github

To maintain the structure, workflow and to easily monitor the project we have made a repository on Github for this project. As requested by our projectmanagers the git is public for further enhancements in the future by other international students.   
You can find the repository on:   
<https://github.com/OAMK-Smart-Kitchen/Smart-Fridge-OAMK>

# The idea’s and brainstorm

Because we only got a title, and a few start-ideas, of the project we were totally free implement the technologies and features in the fridge that we wanted. This gave us a lot of freedom, but also took a lot of time for research , brainstorming, achievable/serviceable technologies and thinking about what would be handy and what the user would like to have extra in his/her fridge at home.

* User recognition:   
  + **Fingerprint reader in handheld:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Very unique (for each person) | You have to touch something |
| Reliability | Difficult with wet fingers |
|  | Waiting-time |

* + **Active RFID key-hanger or card:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Detection on distance | Physical object |
| Multiple use and handy | Can mix up multiple users |
| Cheap |  |

* + **Kinect face-recognition:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Challenging | Delay(?) |
| Automatic recognition | Height of camera |
| International team-work | Complex |

* + **Face-recognition Raspberry-Pi:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Automatic recognition | Delay(?) |
| Cheap | Height of camera |
|  | Reliability |

* + **Voice-recognition:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Accessibility | Complex |
| Cheap | Reliability |
| Fun |  |

* + **Motion-detection:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Energy-saving (only on when motion) | No direct user-recognition |
| Cheap | Reliability |
| Easy |  |

* Product recognition and recommendation:  
  + **Barcode-reader:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Existing databases | Finding a fast way to scan it |
|  | By hand |
|  | Takes time |

* + **NFC-tag:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Wireless | Attach on the products/tray |
| Stickers are cheap | Reader on every place |
| Place-independent |  |

* + **Mechanical detection/hatches:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Overview and organization | Moving parts |
| Reliability | Expensive |
| Not possible to take other product |  |

* + **LED’s/ LED-strip:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Clearly what product it is | User can take other products. |
| Colors for good and bad |  |
| Fancy |  |

* Health-detection:
  + **Integrated scale:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| User-assuredness | Big surface-area |
| Possibility to calculate BMI | View |
| No extra action required (for user) |  |

* + **Personal point-system (based on earlier snacks):**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Motivating for users | Requires many properties of user |
| Competitive |  |
| Possibility to turn off feature |  |

* + **BMI-calculator:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Easy calculation | Requires (many) properties of user |
| User can compare to average | Frustrating |
| Possibility to turn off feature |  |

* Communication/Platform:
  + **Raspberry Pi:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Performance | Limited hardware ports |
| All-in one computer |  |
| Internet-connection |  |

* + **Arduino:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Perfect test-device | No internet-connection |
| Many possibilities | Limited hardware-set |
| Cheap |  |

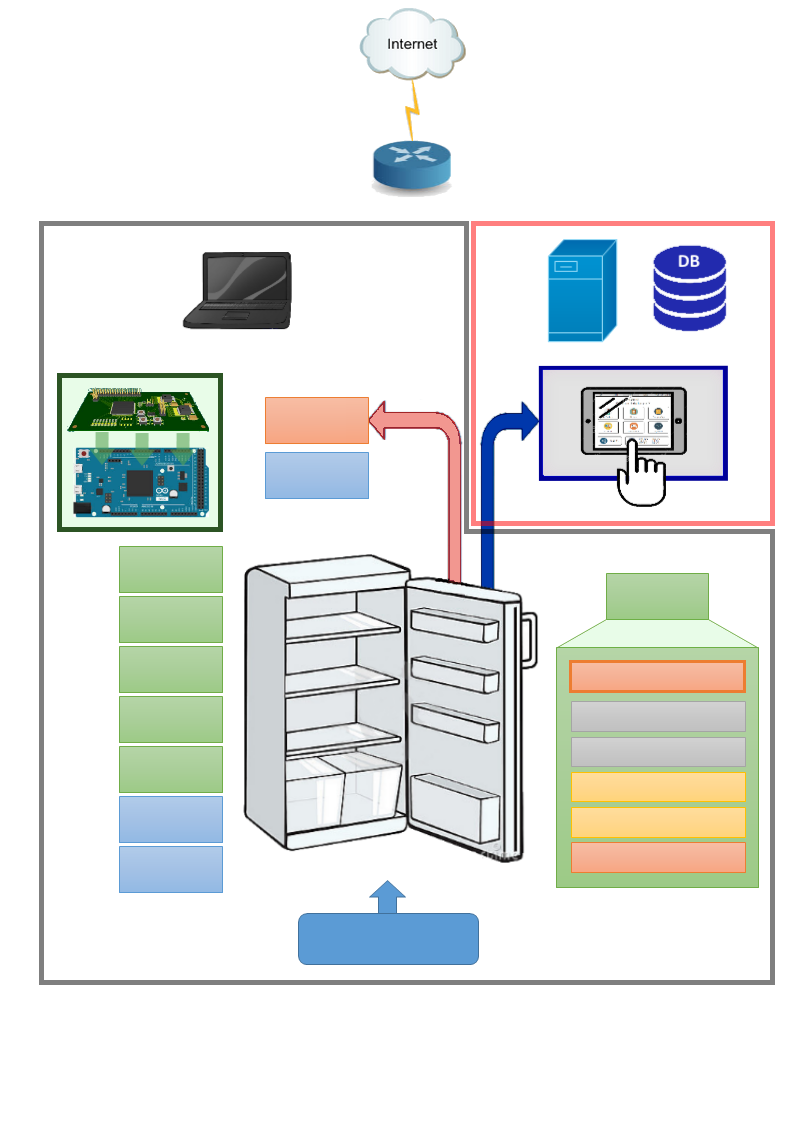
* + **Wi-Fi and Ethernet (LAN):**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Connected devices | Security |
| Software updates |  |
| Monitoring |  |

* + **Bluetooth:**

|  |  |
| --- | --- |
| **PRO** | **CONTRA** |
| Peer-to-peer | Not always reliable |
| Not connected to the internet | Possible delays |
|  | Can only connect 2 devices at once |

1. The conclusion

After lots of research and discussing about what are the best technologies and what is realistic in this amount of time we came up with this as the best starting idea:

**...**   
Up to 127 different devices on the same I2C-bus.

(Serial) Level - convertion

RGB - LEDSTRIPS

Addressing + LED driver

NFC reader

Addressing + NFC driver

I2C - Protocol

**Products with NFC-tags**

**Product   
Module 5**

**Product   
Module 4**

**Product   
Module 2**

Server Database

**UI/Server side**

**Embedded side**

**Product   
Module**

Temp. IN 2

Temp. IN 1

**Product   
Module 1**

**Product   
Module 3**

Temp. Out

Motion sensor

Tablet

Custom PCB + DUE

Computer

Router

1. Estimated Gantt-chart:



# The Annex:

Content:

Will be added soon.

Images:

* Front-page image:   
  <http://www.revistaexclusiva.com/?p=25851>