Project FoSIBLE
Fostering Social Interactions for a Better Life of the Elderly

D3.3 – Early hardware prototypes

Responsible

Fraunhofer IMS

Mauser Care

Deliverable

D3.3 – Early hardware prototypes

Version: 1.0
Date: 21/12/11
Dissemination level: (PU, PP, RE, CO): PU

Abstract

The objectives of this work package are to develop and build prototypes of the interfacing devices that can be used to proof the new interaction concepts. These prototypes will be a combination of sensors and actuators with furniture. As a result, the goal of this work package is to develop a set of “smart” furniture that accompany the TV based applications by natural and intuitive user input and output options. This deliverable is the third of six from the work package 3 and the scope is to build an early hardware prototype based on the mockups and concepts from deliverable 3.1 und 3.2.

Table of Content

1. Introduction

1.1 Background and Related Tasks

Task 3.1: (Responsible: Mauser Care, Collaboration: FhG IMS) Development of concepts for innovative devices/furniture, with sensors for input and output. This includes the creation of concepts on how to integrate these sensor data from the environment into the social media center applications. Currently plans target at sitting furniture, beds as well as wardrobes and sideboards. Note that in order to come up with prototypes within a short time frame, only sensors that are available on the market will be considered. Currently, application of the following sensor types is considered: proximity sensors (capacitive measurement), RFID-based sensors, infrared based sensors. Note that this list is not exhaustive.

Task 3.2: (Responsible: Mauser Care, Collaboration: FhG IMS) Development of proof of concepts (prototype based) on the basis of the developed concepts for testing validity and acceptance by end users. Development will be done in two phases. During the first phase, mock-ups will be created that provide the test users with look and feel of the final devices. These mock-ups will be used to gather first user feedback. In the next phase, a set of full functional prototypes will be created that will then used to gain detailed and exhaustive end user feedback.

Task 3.3: (Responsible: Mauser Care, Collaboration: FhG IMS) Integration of hardware and software components (platform). These prototypes will make use of standard communication solutions (wireless) to connect the sensors with the application platform.

Task 3.4: (Responsible: Mauser Care, Collaboration FhG IMS) Combine the devices for input and output and the software applications in order to make them usable for remote interaction.

Task 3.5: (Responsible: FhG IMS, Collaboration Mauser Care) Development of hardware interfaces for different locative scenarios (e.g. different rooms). This task also addresses using of the shelf domotic sensors (e.g., motion detectors) in order to gather valuable information about the current state of the habitant.

Task 3.6: (Responsible: AIT, Collaboration Mauser Care) Integration of a vision-based sensor technology into a furniture object to explore the posture and facial expression of the users.

1.2 Scope of This Deliverable

The objectives of this work package are to develop and build prototypes of the interfacing devices that can be used to proof the new interaction concepts. These prototypes will be a combination of sensors and actuators with furniture. As a result, the goal of this work package is to develop a set of “smart” furniture that accompany the TV based applications by natural and intuitive user input and output options. This deliverable is the third of six

from the work package 3 and the scope is to build an early hardware prototype based on the mockups and concepts from deliverable 3.1 und 3.2.

2. General

2.1 Location

The prototypes described in this document are located in the application laboratory "Service Apartment" from the Fraunhofer-inHaus-Center. The Fraunhofer-inHaus-Center is the innovation workshop of Fraunhofer-Gesellschaft for smart homes and smart buildings, especially for solutions for residential and real estate properties.

Figure 1: Service Apartment

As can be seen in Figure 1 the prototypes are built up in the application laboratory. This allows us to present and evaluate the acceptance of the prototypes with the end-users in a realistic environment.

2.2 Overview

The project FoSIBLE focuses on the user's home environment, furniture as everyday objects are a promising tool for this purpose. The user has in his immediate surroundings furniture, which are used by him in different ways. Furthermore, the inclusion of TV furniture is quite appropriate, because the output of the Community Social FoSIBLE is mainly located on the

TV. This suggests the integration of a device which can be in the near of the TV. A mobile solution meets this requirement and in addition it allows us to offer further features in the home environment. Thus, in addition to the interaction with the TV it is also possible to interact with the actuators in the environment.

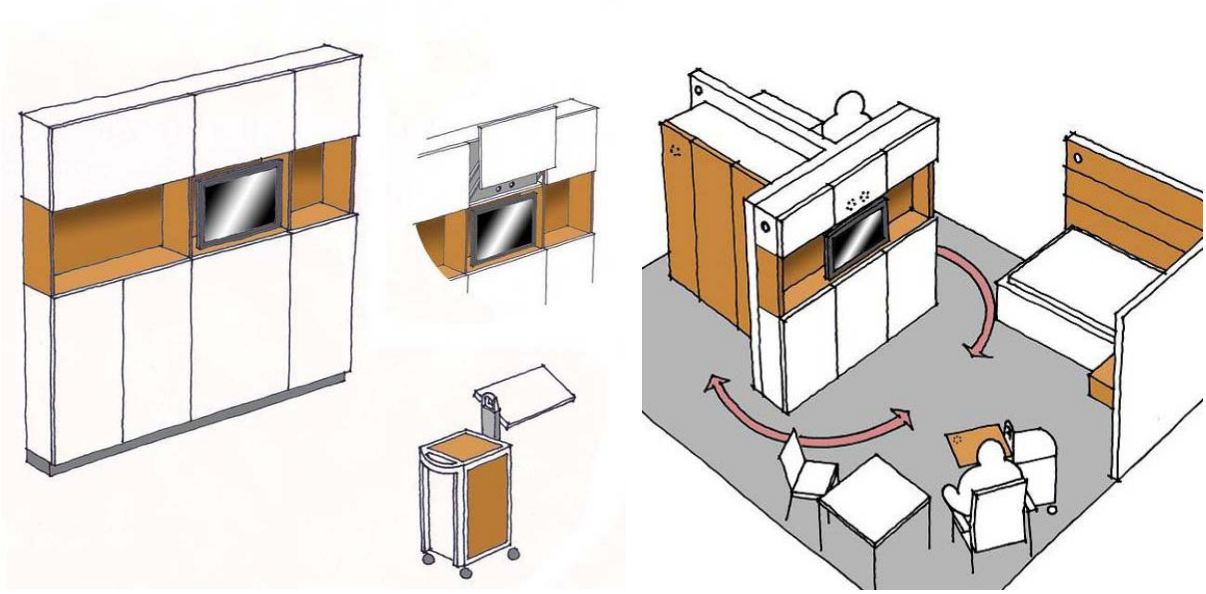

Figure 2: TV environment with mobile unit

In addition to the user interfaces which are intended for direct user interaction with the surrounding area, additional sensors in the users environment are available which allow capturing the action of the user. Correspondingly are sensors in the cabinets and drawers available, so-called reed contacts, which can detect if a cabinet door or a drawer are opened or closed. Based on these values it is possible to infer the physical activity of the user, as well as the currently executed activity. A description of the calculation of this value is entered in chapter 3.

The central software which is responsible for the communication of all devices is the Mauser Runtime. This is described in chapter 5. The Runtime generates abstract events from the sensor information in the apartment and transmits them to applications. Thou the applications do not have to worry about processing the sensor information and can directly work with the events. There is also the possibility that applications can share their own computed values, so in turn other applications can work with these values as an abstract event.

2.3 Prototypes

The prototypes presented here are especially with the embedded sensors provided environment and also the Smart Trolley. The sensor environment (Figure 3 b) is the base for calculations of person-related data and is described in chapter 3. The smart trolley (Figure 3 a) serves as the center for all sensor events, as the communication interface with the FoSIBLE social community and also as an input medium. It is described in chapter 4.

Figure 3: (a) Smart Trolley (b) TV wall with integrated sensors

3. Sensor/Actuator Environment

In order to evaluate the current situation and the calculation of personal information in the Service Apartment, the with sensors equipped furniture are used. These allow us to recognize the opening and closing of the cabinet doors. Based on this it is possible to close the current action undertaken by the residents. This recognition allows generating action specific user recommendations. The recognition of the actions is not available at the present stage of the project and will be implemented at a later date.

Figure 4: Cabinet elements in the Service Apartment

In Figure 5 the sensors can be seen in the cabinet. In the same line all the sensors are installed in the apartment. Simple reed sensors detect the opening or closing of the door, as in this case, the magnetic contact is opened or closed. Behind every major unit, e.g. a wall unit is a microcontroller board that receives the 1-bit signals from the reed sensors and sends them as whole to the Mauser Runtime. The sending takes place via TCP to the FoSIBLE sensor interface. This takes up the signals and processes them.

Figure 5: (a) Sensors in the cabinet door (b) Detailed view

An Example Application for the sensor interpretation is the “Activity Index”. It can determine different context information to an "Activity Index" which indicates whether the user was in the last time very active or not. Using this value, the user should be tempted to do more. The decrease of the index can be counteracted by a course visit, playing a game or sporting activities. These are recorded by the system and afterwards provide the opportunity to give comments and share the event information among each other. Through sharing of the events, other participants of the social community become aware of his activities; thereby the other participants can be motivated to join the user during the next course. This scenario can be applied to games in the same way.

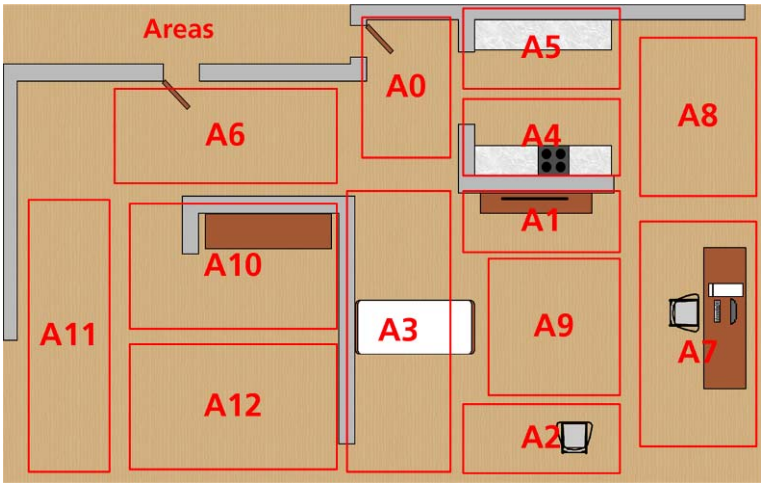

Figure 6: Subdivision in areas

To determine the value the service apartment is divided into different areas (Figure 6). First the stretches of way between the areas are converted into a graph (Figure 7), which includes

the distances between the adjacent areas. Based on the graph it is possible to determine the distance traveled by the user with the help of a simple algorithm. For this purpose, the triggered events are assigned to an area. In addition, the area in which the last event has occurred is marked. Once an event is executed in a different area, the traveled distance is determined based on the graph. The traveled distance is then added to the "Activity Index" depending on the required time based on the user-specific mean values .If too much time passes by without an event taking place in another area there is a reduction of the "Activity Index", so the value may also decline again.

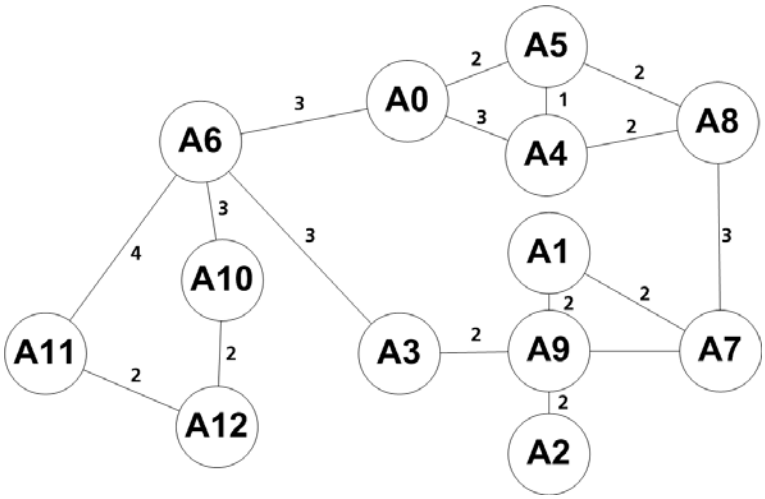

Figure 7: Graph representation of the areas

This index can be displayed in the community so that the user can see a direct connection between his actions in real life and in the virtual world. The index can also be used as a value in a point system, allowing the user to collect points in order to show his activity in the community. His points can be increased by the "Activity Index", as well as by participating in events. So the user will have an incentive to register and comment to attended events.

Figure 8: Activity index in the FoSIBLE widget

4. Smart Trolley

Based on the knowledge acquired in the project, that users usually are reluctant to change the familiar furniture, has therefore led to the development of a new concept in Deliverable D3.. The new mobile element has been designed for the integration of controls, which serves as an extension to existing furniture. The newly worked out element is to be regarded as a mobile unit that can be placed on the required position and used there. This has the advantage that the user can use the FoSIBLE functions not only in the chair, but at several places. The user can carry the piece of furniture and thus has the interaction elements in the immediate vicinity.

The "Smart Trolley" consists of various components. We realized in the middle of the surface a gesture input area (Figure 9) that responds to different touch gestures. This touch gestures allow us to control the environment on the basis of simple inputs. The installation of the touch surface in the Trolley is only seen as an example application. It is planned to use the touch surface at different places. For example, the touch surface in a heavy closet door. This allows then the lightweight opening over a wiping gesture. For this purpose, cost-effective alternatives will be reviewed to make it possible to use this feature in a product.

Figure 9: (a) Touch screen for gesture recognition (b) Integration under the wood panel

Currently the control of the TV takes place via the wiping gestures. In this example (Figure 10), the wipe from left to right is interpreted as the TV remote control input "right" and sends this signal to the TV. Furthermore, basic functionalities are marked as buttons on the surface. This can be seen in Figure 9 a as points and on Figure 10 as the underlying functions. The points will soon be replaced by markings on the surface, matching the functions.

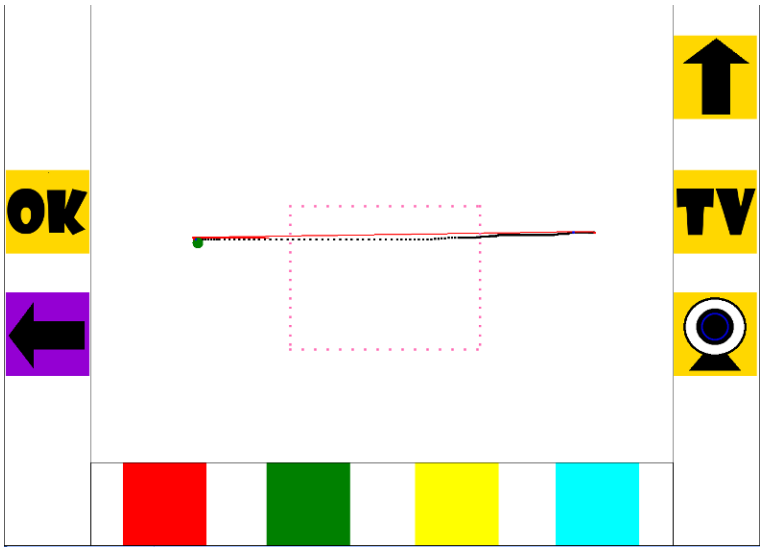

Figure 10: Interpretation of the touch input, here gesture "right"

The sending of the control information is sent to the TV via an infrared transmitter (Figure 11). This can completely replace the TV remote control. The entering of text via gestures is not optimal. Therefore, only the basic functions have been used.

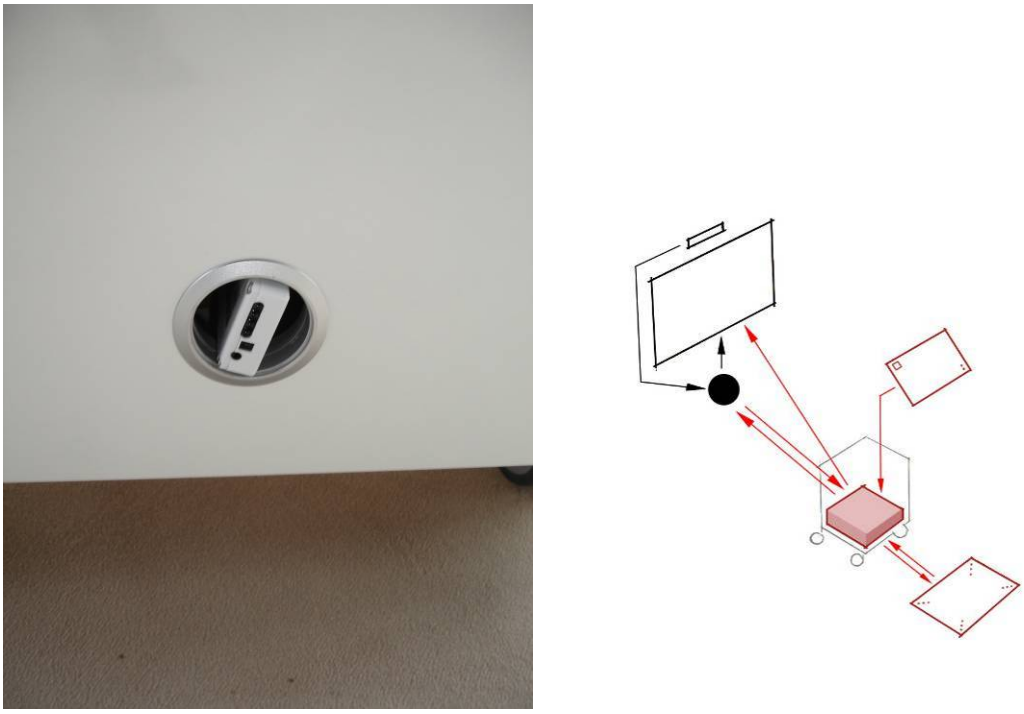

Figure 11: IR sender intigrated in the trolley

The "Smart Trolley" also includes the runtime as the central element. In this way the apartment must not already be smart. The trolley comes with the basic functions of a smart home. These can then be expanded using the trolley. For this purpose the Mauser Runtime is compatible with others systems. The project was used for the demonstration of an enOcean gateway. This allows setting up all functions from a smart home.

Figure 12: Integration of the Mauser Runtime in the Smart Trolley

Currently the computer for the Mauser Runtime is housed in a drawer. It is planned to integrate the computer in the body of the trolley and hence make them invisible to the user.

5. Mauser Runtime

The Mauser Runtime is the central software which is responsible for the communication of all devices in the service apartment. The sensor information can be prepared for the further processing. Subsequently the FoSIBLE-specific interpretation of sensor events occurs on a higher application layer.

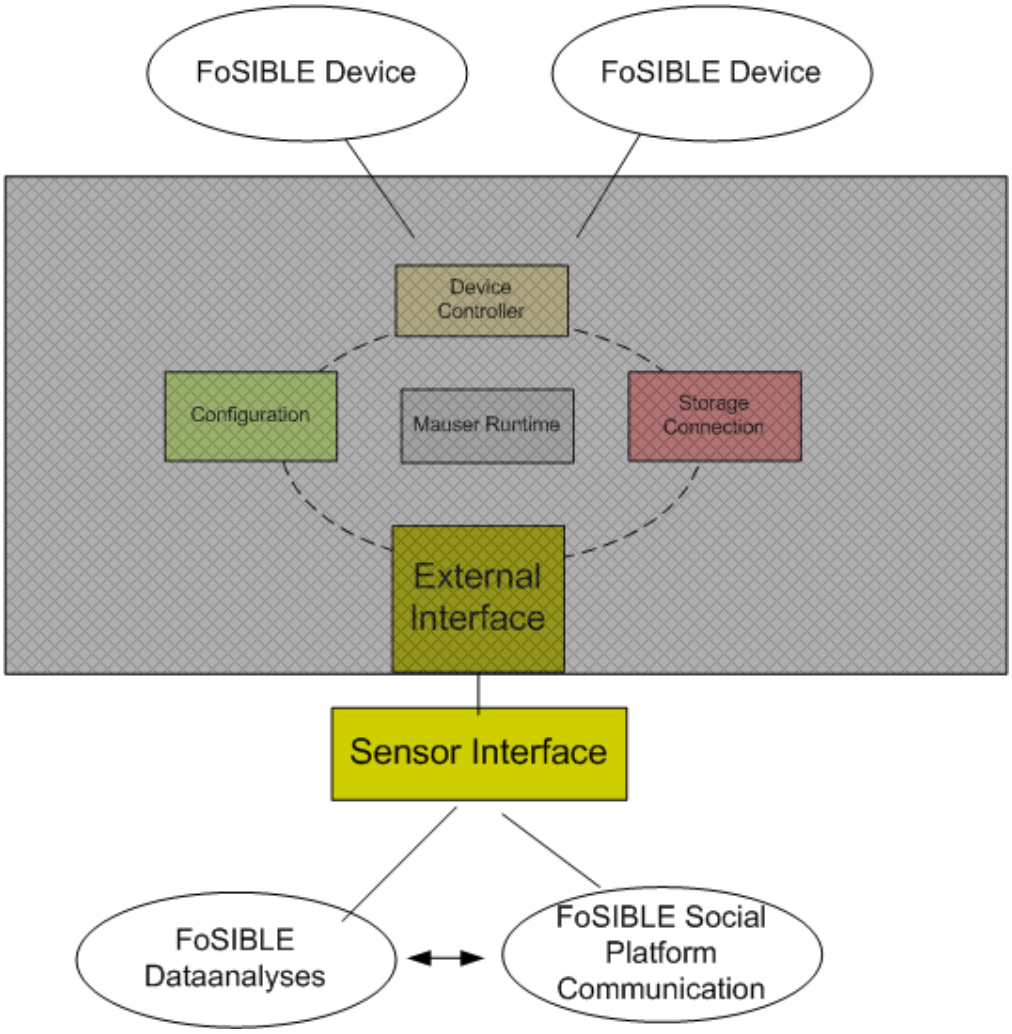

Figure 13: Overview Mauser Runtime

Developed for this purpose the Mauser Runtime (Figure 13) allows the integration of multiple sensors of the building automation bus "enOcean". These afford the sensors to receive and provide content for other applications. The device access used in the Mauser Runtime is, based on the changeability of the requirements, abstract, so that the currently used components can be replaced in the future, without any adverse effects taking place at a higher application layer. In addition, applications can create their own events, which in

turn can be used by other applications. This has the advantage that the individual components are easily maintainable and interchangeable.

The Mauser Runtime consists of associated device controllers that are responsible for processing the device data. The devices are kept abstract, so that a replacement of a device does not disrupt the system itself. The collected data can be buffered in a database, so that by switching off the Mauser Runtime the content will not be lost and it can be retrieved after rebooting again. For connecting external applications the Mauser Runtime includes an interface that can be addressed via TCP. Detailed information about the interface takes place in chapter 5.1. Furthermore the Mauser Runtime has a communication interface for the FoSIBLE Social Platform, so that a data exchange can be done. Please see chapter 5.2.

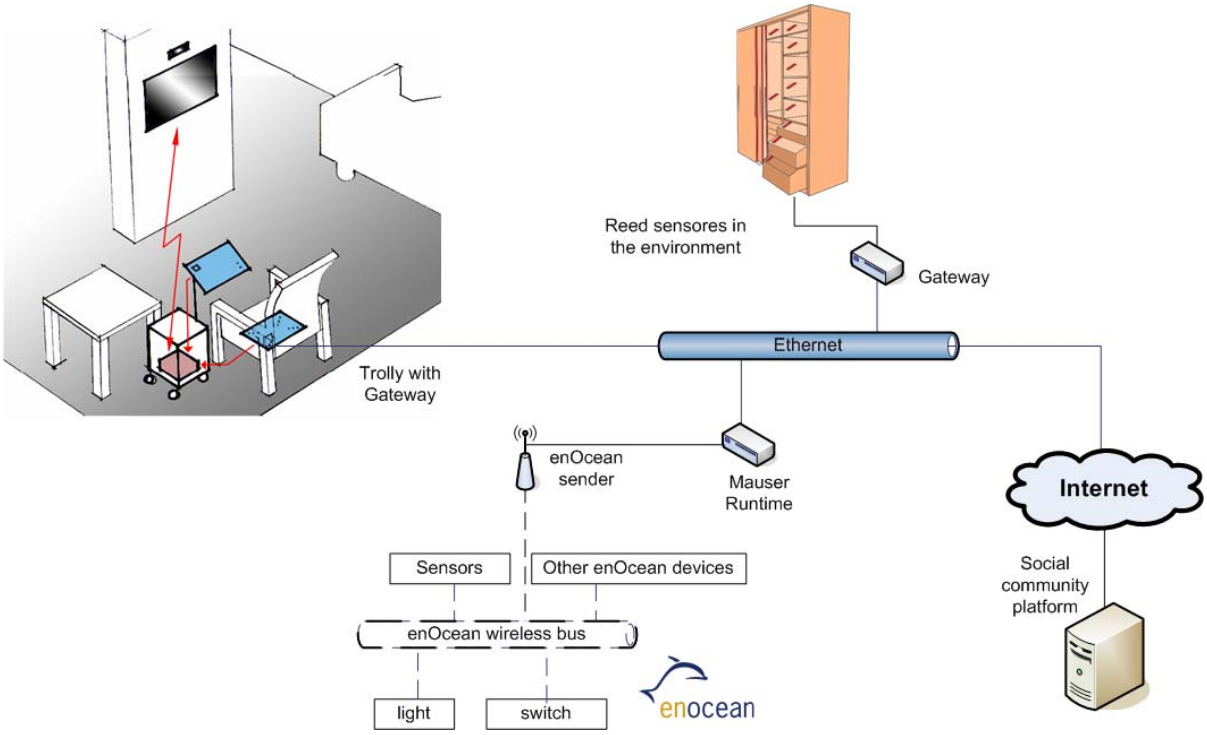

Figure 14: Communication between the components

As illustrated in Figure 14 the individual components communicate with each other by the Mauser Runtime. Mauser Runtime processes the incoming signals into virtual events and afterwards they can be interpreted by applications. Via LAN all components can exchange data, whereat the device signals will be readout by the Mauser Runtime by radio or cable and then converted for sending them by IP, so that they can be sent via LAN too.

5.1 FoSIBLE Sensor Interface

The FoSIBLE sensor interface allows external applications to communicate with the Mauser Runtime by the TCP protocol. Therefore a port on the Runtime monitors incoming inquiries to start an initialization in which external applications can register to the Mauser Runtime. After successful registration various methods for external applications are available. Furthermore relevant events for the external application will be forwarded, so they can react. The data exchange occurs by so-called JSON objects, because they do not need large amounts of data and are easy to parse. Detailed guidance for communication will be developed together with partners in the prototype development.

5.2 FoSIBLE Social Platform Interface

The FoSIBLE Social Platform is a web-based server solution, which is simply accessible by internet connection. For this reason the Mauser Runtime receives a HTTP-protocol-based interface, which affords a communication with the Social Platform. This allows the Social Platform to receive different status messages by the Mauser Runtime, as well as to leave simple messages at the user-specific presentation-site of the Social Platform. In this way it is possible to create several messages at furniture and send them directly to the Platform. This message can be for example an advice to the user's actual condition, which can be pictured by icons. But this method of implementation belongs to the applications, which are based on the Mauser Runtime and therefore they will not be explained at this point