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

Deliverable

D5.4: Prototypes of input/output devices integrated in furniture, Delivery date: M18

Responsible

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Abstract

D5.4 reports the work on the integration of the 3D sensing devices used in the project FoSIBLE into a furniture object. The document and discusses several options and gives design examples for the integration.

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1 Introduction

1.1 Purpose of the Document

The purpose of this document is to report the work on the integration of the 3D sensing devices used in the project FoSIBLE into a furniture object that will be positioned in the living room of the elderly end user. The document discusses several design variations with their advantages and disadvantages and shows graphics of design examples.

1.2 Definitions, Acronyms and Abbreviations

Acronym	Description
FoSIBLE	Fostering Social Interaction for the Well-Being of the Elderly
IF	Interface
PC	Personal Computer
AE(R)	Address Event (Representation)
3D Sensor	Devices that delivers spatial (three dimensional 3D) information of a given scene , typical x,y and depth-z
SW	Software
HW	Hardware
TAE	Timed address event data
OS	Operating System
USB	Universal serial bus
MS	Microsoft ®
PCB	Printed circuit board
R/C	Remote control

2 Overview

2.1 Goal of the sensor integration

An appealing appearance and functional compatibility will be the key issues for the successful integration of the 3D sensors into a furniture object for use by the elderly. The sensors that will be used for the gesture navigation through the iTV application and for the "social state monitoring" shall integrate seamlessly into the furniture object [5]. The impression of a camera that is watching the user must be prevented.

2.2 Requirements

The two 3D sensors selected within the FoSIBLE project are the Kinect device from Microsoft which is commercially available since 2010 and the UCOS2XL device from AIT [1], which is a prototype of a 3D sensor (based on optical stereo processing) utilizing two biology-inspired optical sensor chips. As the both sensors working principles are based on optical sensing a free field of view must be achieved allowing the user to interact with the sensors/system in a wider area in front of the furniture object.

3 Sensors specifications with respect to integration

3.1 Kinect Sensor

The Kinect Sensor exhibits a black plastic housing with a stand foot but no possibility to mount the device firmly by screws, etc. Current mounting options for this device are limited to gluing the stand foot onto an even surface. In the front of the device three round openings are present, two needed for the 3D sensing function and one camera lens. The two openings for the 3D sensing function are the most distant ones, the camera lens is located between the two. For the 3D sensing capability the two most distant openings have to be kept free from occlusion, a covering of these openings with glass might deteriorate the quality of the 3D sensing. Drawing of the device with dimensions is given in Figure 1.

The device is connected to a PC or XBOX device via one USB cable attached to the back of its stand foot. The USB connection also supplies power to the device. The device is actively cooled by a fan located inside the housing. The left and right sides of the device exhibit air-flow openings that must not be covered. This has to be respected when integrating the device into the furniture object.

Disassembly of the sensor into its electronic components (e.g. to PCB board level) is not possible because of product liability issues. Furthermore it is doubtful if a device disassembled in such way and mounted into the furniture object would be fully functional.

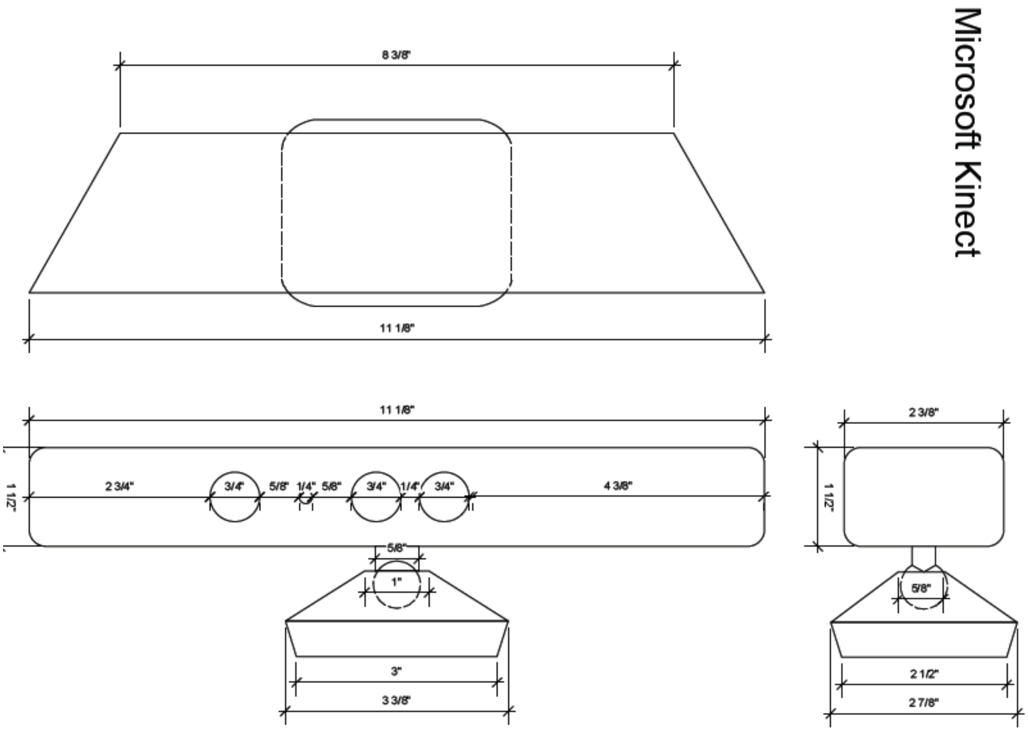


Figure 1. MS Kinect technical drawing with dimensions in inches (source [6]).

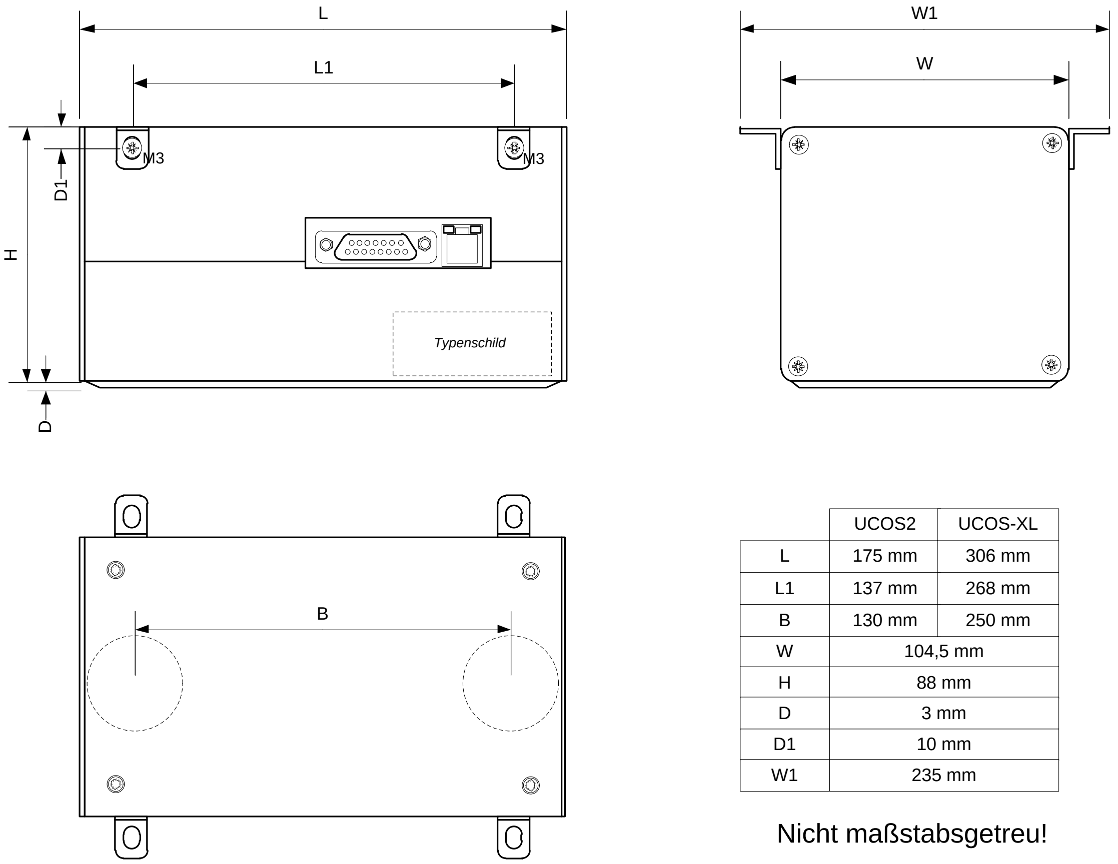
The device field of view is limited by an angle of 57° horizontally and 43° vertically which has to be observed in the placement of the device within the furniture and in the placement of the furniture itself with respect to the main seating-accommodation in the room. The range of the 3D sensing is limited to 5m from the device.

3.2 UCOS2XL Sensor

The UCOS2XL Sensor exhibits an uncoated aluminium housing with four M3 mount holes at its two longer sides. In the front of the device two round openings are present, needed for the 3D sensing function. For the 3D sensing capability the two openings have to be kept free from occlusion. A covering of these openings with glass is permitted as long as the attenuation of the light intensity is kept below 5%.

The device is connected to LAN infrastructure via an Ethernet cable with a RJ45 connector. The RJ45 socket is located at the side of the device. The device is supplied with external DC power via an SUBD connector located next to the Ethernet socket. The device needs not to be cooled actively which enables a more easy integration into the furniture object. Drawing of the device with dimensions is given in Figure 2.

The UCOS2XL sensor functional components are placed on a single PCB board that can be removed from its housing and can be integrated in the furniture and operated on board level. The board offers six mount holes for mechanical integration. **However, in such case additional certifications have to be obtained to commercially operate the device!**



	UCOS2	UCOS-XL
L	175 mm	306 mm
L1	137 mm	268 mm
B	130 mm	250 mm
W	104,5 mm	
H	88 mm	
D	3 mm	
D1	10 mm	
W1	235 mm	

Nicht maßstabsgetreu!

Figure 2. UCOS2XL technical drawing with dimensions in mm.

The device field of view is limited by an angle of 60° horizontally and 60° vertically which has to be observed in the placement of the device within the furniture and in the placement of the furniture itself with respect to the main seating-accommodation in the room. The range of the 3D sensing is limited to 3m from the device, however the range of optical sensing for the social state estimation (i.e. counting the number of persons in room) is basically infinity.

4 Integration Design Options

This chapter discusses design options for a later commercialization of the system.

4.1 Example 1 Adjustable Sensor Mounting

Since end-users might want to interact with the TV/sensor system from various places in the room one approach is the mounting of TV-monitor and sensor package to an adjustable frame that allows the system to change its horizontal angle respective to the wall. That way the optical sensors can always focus on the user(s) position in the room.

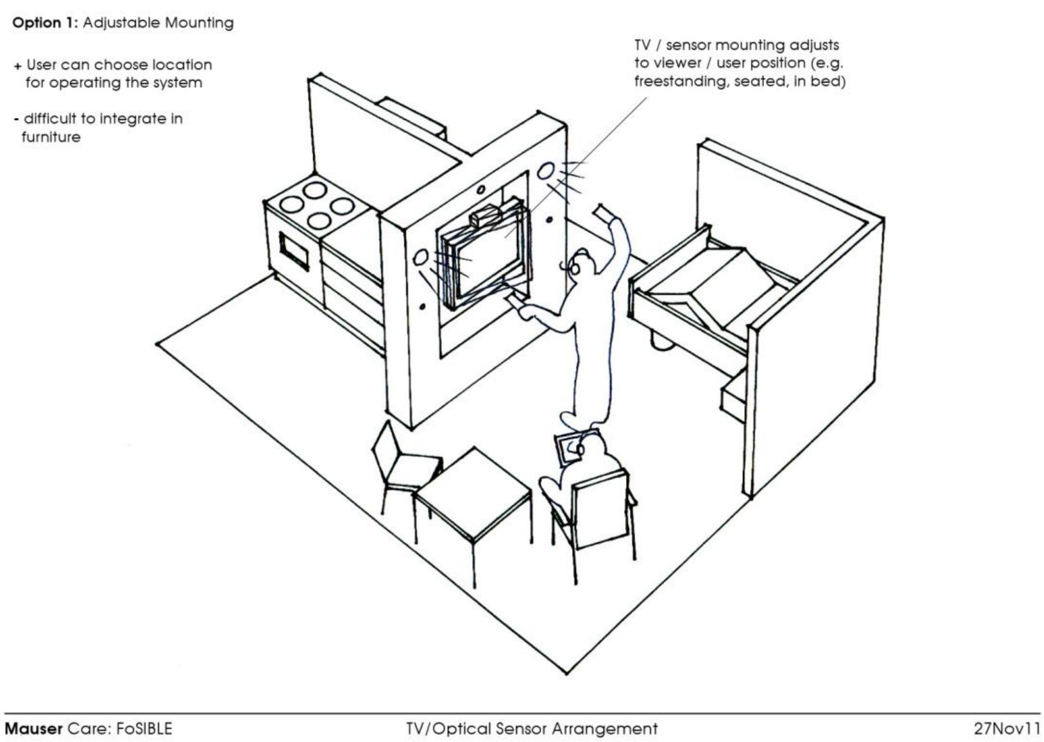


Figure 3. adjustable sensor mounting

Giving the user a lot of freedom using the system this configuration creates a number of issues as far as integration into furniture and control of operation are concerned: on the one hand the adjusting mechanism creates a somewhat obtrusive mechanical look when angled out, on the other the control of operation will either require some automated location of user position or manual R/C operation. Both options seem complicated either from end user or manufacturer perspectives.

4.2 Example 2 Fixed Sensor Mounting

In this case the end-user has a defined space from where to interact with the system, which is integrated in the furniture in a fixed position.

Restricting the end-users freedom of choice to some degree this configuration is less expensive and allows more options of integrating the system into furniture with a less technically looking design. Another advantage is the option to cover the optical sensor when not in use, making a clear separation between on and off situations as well as avoiding the „watching“ effect when not in use.

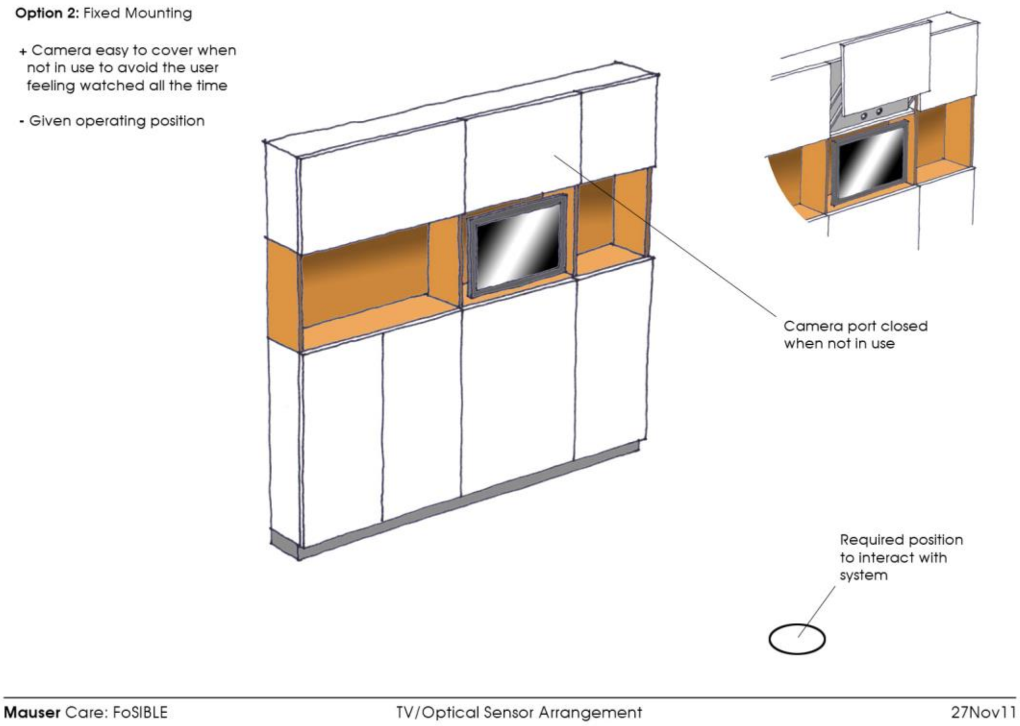


Figure 4. fixed Sensor mounting.

5 Selected mount for the FoSIBLE project

For the sake of simplicity and compatibility with the TV hardware selected a simpler mount adapter had to be realized in the project to connect sensor and TV set. This adapter connects to the VESA mount grid on the backside of the TV set. It allows a firm mounting of the sensor(s) independently of the selected furniture object and also for demonstration without furniture. The Kinect sensor must be optionally glued to the surface underneath it.

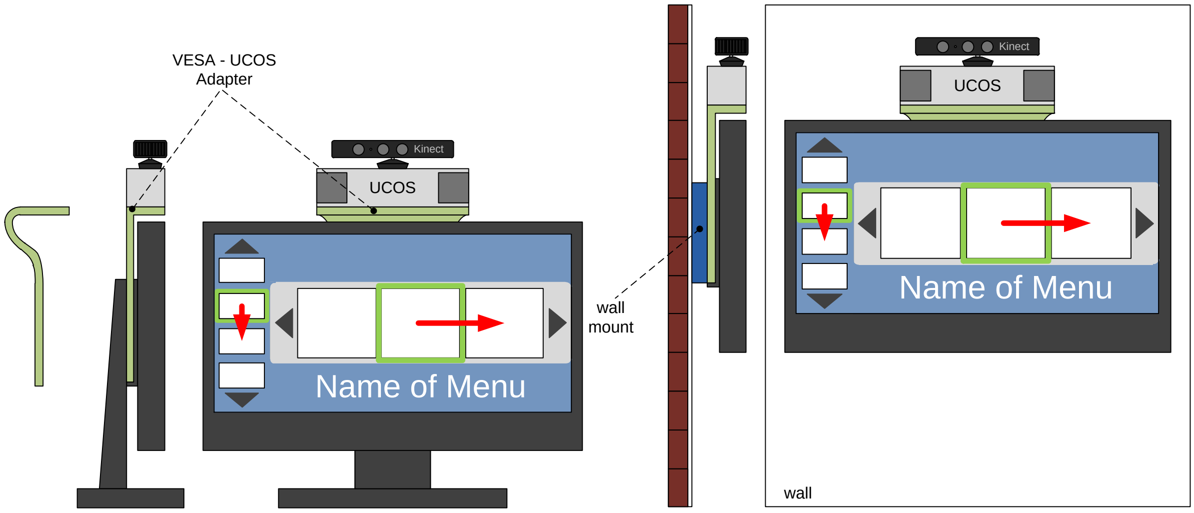


Figure 5. VESA Sensor mounting adapter selected for use in the project.

6 References

[1] UCOS2 data sheet - http://www.ait.ac.at/research-services/research-services-safety-security/new-sensor-technologies/development-of-embedded-systems-for-customer-specific-solutions/smart-eye-ucos-universal-counting-sensor/?L=1 as of 2011-08-31

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[5] FoSIBLE Deliverable D5.1: "Report on requirements of software components and tools for observation and tracking in laboratory and Living Lab environment." Delivery date M16

[6] http://urbanhonking.com/ideasfordozens/files/2011/02/kinect_drawing.pdf, visited Oct. 2011