Pflichtenheft

Virtual Reality for Sensor Data Analysis

Projekt:	Virtual Reality for Sensor Data Analysis 0.1
Autor:	Gero Birkhölzer, Johannes Blank, Alexej Gluschkow, Fabian Klopfer, Lisa-Maria Mayer
letzte "Anderung:	May 2, 2017

Contents

1 Purpose

The software project module in 2017 at the University of Constance focuses on the development of an app for mobile devices.
Especially, this Pflichtenheft intends to describe the structure of an implementation of a virtual reality representation of BLE sensor feedback.

1.1 Mandatory Criteria

M1 The app shall use the Bluetooth adapter of the smartphone to connect to a TI SimpleLink SensorTag device.

M2 The app shall track the position of a TI SimpleLink SensorTag device with up to 30m tolerance.

M3 The app shall visualize the sensors' data and its position using 3D/stereoscopy, more concrete the WebVR framework.

M4 The visualization mentioned in M3 shall be explorable by tilting the joystick of a bluetooth controller.

1.2 Desired Criteria

A1 The app shall visualize the sensors' data and its position using augmented reality.

A2 The VR-World shall represent a whole corridor with more than two rooms.

2 Product Environment

2.1 Software

- Android 5.0 Lollipop or higher

2.2 Hardware

- Bluetooth-enabled Smartphone
- TI SimpleLink SensorTag device
- Victorstar VRBox 2.0
- VR-Park Bluetooth Controller

3 Product Functions

3.1 General Features

F1.1 The app shall use the Bluetooth adapter of the smartphone and the Android.bluetooth library to connect to a TI SimpleLink SensorTag device.

F1.2 The app shall provide a live data view of the sensor feedback in human readable form.

F1.3 The app shall track connected TI SimpleLink SensorTag devices.

3.2 VR-World

The VR-Mode is a 3D view of the world. When entering VR-Mode the user will see a fullscreen 3D world and by pressing the button in the lower right corner he can enter the stereoscopic view of the World. The VR-World is a 3D representation of a real series of rooms.

F2.1 The VR-World shall model at least two different rooms and a connecting hallway.

F2.2 The VR-World shall be able to be viewed inside a web browser and from within the app.

F2.3 The VR-World shall have a stereoscopic 3D mode of the world.

F2.4 While viewing the VR-World the user shall be able to look around using the gyro sensor of his phone to pan the camera around.

F2.5 While the app is not in stereoscopic 3D mode the user shall be able to click and drag to pan the camera around.

F2.6 The app shall be able to move the camera inside the VR-World by using a bluetooth controller.

F2.7 The data fechted from the sensors shall be displayed inside the VR-World.

F2.8 When in VR-Mode, the app shall be in fullscreen mode.

F2.9 The app shall exit the VR-Mode if the user is pressing the “x” in the top right corner of the screen or if the user is looking directly at the “x” under his feet for 5 seconds .

F2.10 The app shall be able to switch between stereoscopic 3D and normal 3D mode.

F2.11 The app shall be able to switch from fullscreen VR-Mode to stereoscopic by pressing the button in the lower right corner or by pressing the A-Button on his controller.

F2.12 The app shall be able to exit the stereoscopic 3D mode by the user looking at the “x” under his feet for 5 seconds or by pressing the back button on his device or by touching the back button in the top left corner.

F2.13 The app shall be able to switch to the settings screen when it is in normal 3D mode.

F2.14 The app shall be able to switch rooms if the user pushes the B-Button on his controller or by looking up at the door sign for at least 5 seconds when the app is in a visualization state.

F2.15 The app shall visualize the position of connected TI SimpleLink SensorTag devices.

3.3 Settings

The user can set the following options:

F3.1 The app shall be configuarable so that the user may choose wich data shall be displayed in the VR-World (temperature, etc.).

F3.2 The app shall list the connected devices and a short info about the current setting and state of the TI SimpleLink SensorTag device.

F3.4 The app shall list the results of a Bluetooth scan and present an user interface for controlling the connection of TI SimpleLink SensorTag devices.

4 Proposed Architecture

4.1 Overview

4.1.1 Services

From AndroidDoc:
"A Service is an application component that can perform long-running operations in the background, and it does not provide a user interface".

- **SensorTagBluetoothReceiverService:** Uses the android.bluetooth and especially the android.bluetooth.le libraries to fetch the sensor data from the TI cc2650.

- **SensorTagTrackingService** Handles the tracking of the TI SensorTag devices.

4.1.2 Activities

From AndroidDoc:
T̈hey (Activities) serve as the entry point for a user's interaction with an app, and are also central to how a user navigates within an app (as with the Back button) or between apps (as with the Recents button).̈

- **MainActivity** Provides the main startup screen as the main entry point.
- **VRViewActivity** shall provide the WebVR view using the android.webkit library (esp. .webview).
- **LiveDataActivity** shall provide a view of the sensor data in human readable form.
- **TISettingsActivity:** Settings screen containing scanning & connecting, connected devices and device settings fragments.

  - **ScanningConnectingFragment** shall show the scanning results, delivered by the SensorTagBluetoothReceiverService and controll to which device to connect to or disconnect.
  - **ConnectedDevicesFragment** shall show a list of all connected devices and a short info about the current setting and state of the TI SimpleLink SensorTag device.
  - **ConnectedDevicesSettingsFragment** shall implement the configuration of the app features of the sensor.

4.1.3 Additional Classes

- GATT characteristics and profiles for the sensors including extraction operations from raw to get proper values.

5 Product Data

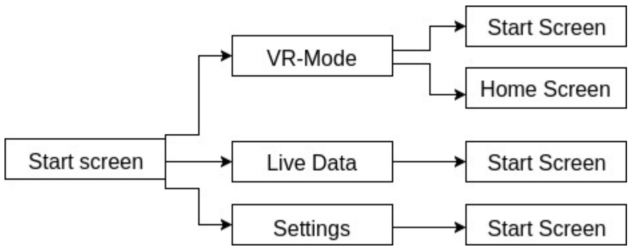
TODO: MockUp/Interface einer Projekt 4 Gruppe
TODO: Was muss für 3D Modell gespeichert werden? Wie sehen die Datenstrukturen aus?

6 User interface

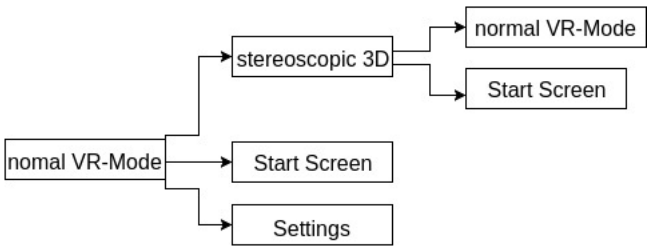
6.1 Structure

A small overview of the menu Structure.

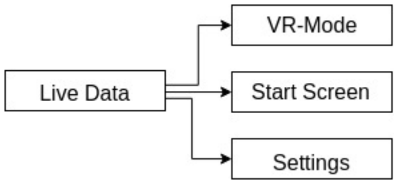
6.1.1 Start screen



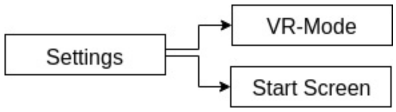
6.1.2 VR-Mode



6.1.3 Live Data



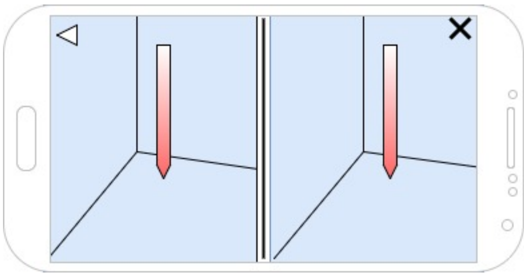
6.1.4 Settings



6.2 Layout

A mockup of the Start up screen.

And a mockup of the stereoscopic Vr-Mode.



7 Quality Requirements

	very important	important	less important	lesser important
Robustness				**X**
Reliability	**X**			
Correctness	**X**			
Usability	**X**			
Efficiency		**X**		
Portability		**X**		
Compatibility			**X**	

8 Test Cases

/T0300/ *Look around:* While in normal 3D mode the tester shall click the screen and drag first up to move the camera up. Then move down to move the camera down, then at last left and then right, all the time the camera must follow the movement of the finger. After this the tester shall tilt the phone up to move the camera up, then tilt it down, left and right. The camera shall follow the tilt direction of the phone all the time with no delay.

This test will be repeated in stereoscopic 3D view, while the clicking and dragging shall not work, the tilting of the phone shall be the only way to pan the camera.

/T0310 *Move inside VR-World:* While in nomral 3D mode the Tester shall tilt the joystick on the conrtoller forward and the camera shall move forward. By tilting the joystick backward the camera shall move back, by tilting left the camera shall move left and by tilting right it shall move right. The camera shall allways follow the view point, so forward is allways in the center of the camera.

This test shall be again repeated in stereoscopic 3D view and all funcitons shall work the same.

9 Development Environment

9.1 Software

OS	Windows 10
IDEs	◇ Android Studio ◇ Sensor Controller Studio 1.4.1
VCS	Git & GitHub
UML-Editor	Enterprise Architekt/MS Visio/draw.io
Zeichensatz	LaTeX

9.2 Hardware

Smartphone	Motorola XT1572
Sensor	TI CC2650STK
VR-Headset	Victorstar VRBox 2.0
Bluetooth-Controller	VR-Park (?)

10 Project Time Line

02.05.2017 release Pflichtenheft incl. project plan and subject of the milestones

25.05.2017 Milestone 1

12.06.2017 Milestone 2 & intermediate assesment

17.07.2017 Milestone 3

25.007.2017 Final presentation

Possible starting points:
Simple, bad layout
TI official, complex