Module Title:	**O3 - eHealth Application and Tools**

Coordinator:	University of Applied Sciences Ulm, Germany	**Contact:**	Professor Bernd Vögel Bernd.voegel@thu.de

Suggested Learning and teaching hours	60 hrs
Suggested Independent study	90 hrs Due to the practical approach with a lot of programming, this number is a little bit higher than in other modules.
Module duration (total hours)	150 hrs

Module Aims
The overall aim of the module is to develop students' skills in designing software, mainly mobile applications to enable patients and elder persons to live **longer** independently and to collect medical parameter data in order to monitor the patient or to provide telemedical treatment.

Target Group and Prerequisites
This module is designed for CTS students who have almost finished their Bachelor Degree or who are doing their Master Course. The students must know the programming language Java and basics in database design.

Learning Outcomes
This module contains the means and tools to develop mobile application in the context of eHealth. At the end of the module, the students know • how to design apps • how to process internal and external sensors • how to deploy apps • common standards in communication   ○ especially HL7 FHIR • how to analyse data • how to protect data privacy • which legal and ethical questions have to be considered

Module Delivery Guidance

This module comprises as set of Microsoft Powerpoint presentations, all of which have teacher's guidance notes in the Notes sections of the presentations.

Assessment:

There are two assessments. One is a written exam about the theory, and the other is a group project work to develop a mobile app. They are weighted 30% and 70% for the overall module assessment.

Syllabus and resources:

All theoretical and practical contents on-site are calculated in blocks of 90 minutes, e.g.

- Lectures 2,5
- Laboratory 2

means 2,5 theoretical blocks and 2 practical blocks

- Chapter 1: Introduction
  - Lectures 1
  - Laboratory 0

- General overview of course content and a basic understanding of the term/concept eHealth in this module.
- Files
  - O3_Ch1_TEACHER.pptx

- Chapter 2: Current Situation
  - Lectures 2
  - Laboratory 0

- This chapter introduces the current techniques and standards. It enlights the possibilities in developping a mobile app. It includes a powerpoint presentation, and pdf resources containing guidance on how to validate an app as a regulated medical device.
- Files
  - O3_Ch2_TEACHER.pptx

- Chapter 03: App Development Part 1
  - Lectures 5,5
  - Laboratory 3

- General overview and first steps in App-Development. Further topics are basics about UI and the connection to internal sensors
- Files
  - O3_Ch3_TEACHER.pptx
  - O3_Ch3_TEACHER_EX1
  - O3_Ch3_TEACHER_EX2
  - O3_Ch3_TEACHER_EX3

- Chapter 4: Communication Server & Messages
  - Lectures 2,5
  - Laboratory 2

- Different institutions in the health content have to exchange data of persons/patients. Quite often this not done directly, peer to peer, normally the exchange is done with a communication server/integration engine. In health there is a very well established organization to develop message standards - HL7 (Health Level 7). In this chapter the basics of messages and the different versions of HL7 will be introduced. Furthermore the functionality of an integration engine will be demonstrated on base of Nextgen Connect (former Mirth Connect).
- Files
  - O3_Ch4_TEACHER.pptx
    - O3_Ch4_TEACHER_EX1.pdf
    - O3_Ch4_TEACHER_A1.pdf
- Hardware/Software
  - MirthConnect

- Chapter 5: FHIR Details/Server + Tools
  - Lectures 2
  - Laboratory 2

- HL7 FHIR is the future of messages in Healthcare, mainly in mobile applications. FHIR will be intensively introduced and there will be a detailed look on the corresponding software products
- Files
  - O3_Ch5_TEACHER.pptx
    - O3_Ch5_TEACHER_EX1.pdf

- Chapter 6: DB Techniques
  - Lectures 5
  - Laboratory 3

- Basic repetition of DB and SQL and introduction to approaches of data analysis, e.g. machine learning and time series analysis
- Files
  - O3_Ch6_TEACHER.pptx
    - O3_Ch6_TEACHER_EX1.pdf
    - O3_Ch6_TEACHER_EX2
- Hardware/Software
  - R

- Chapter 7: App Development II
  - Lectures 4,5
  - Laboratory 5,5

- Deeper knowledge of App developing and connection to external sensors/devices.
- Files
  - O3_Ch7_TEACHER.pptx
    - O3_Ch7_TEACHER_EXERCISE1
    - O3_Ch7_TEACHER_EXERCISE2
    - O3_Ch7_TEACHER_EXERCISE2_1
    - Hardware/Software
  -

- Chapter 8: Ethics and juridical aspects
  - Lectures 2
  - Laboratory 0

- Files
  - O3_Ch8_TEACHER.pptx

- Chapter 9: Privacy and Data Security
  - Lectures 1
  - Laboratory 0

- Files
  - O3_Ch9_TEACHER.pptx

Suggested reading list:

App-Development

- Rehg et al.: Mobile Health: Sensors, Analytic Methods, and Applications. Springer, 2017. ISBN: 978-3-319-51394-2
- Phillips et al.: Android Programming: The Big Nerd Ranch Guide. Big Nerd Ranch Guides, 2017. ISBN: 978-0134706054
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Messages/HL 7 FHIR

- Using HL7 FHIR to achieve interoperability in patient health record (Rishi Saripalle,Christopher Runyan,Mitchell Russell)

Suggested links:

App Development

- Android Developer Documentation: https://developer.android.com
- Material Design Guidelines: https://material.io/guidelines/material-design/introduction.html

Messages/HL 7 FHIR

- https://www.hl7.org/fhir/
- https://fire.ly/