Munich Summer School of Applied Science 2020

Course description
Course title: Smart Environments
Hours per week: 20h/week, 2 weeks
Number of credits allocated / work load:
   a) 40 contact hour
   b) 3 US credit recommended
   c) 4 ECTS credits

Short description
A “smart” system can be defined as a system which supports its user in an intuitive way. It normally consists of miniaturized devices with sensors, actors and a computing hardware which acquires data, processes the data to analyse the current situation to finally make autonomous decisions in a predictive and adaptive manner, performing then the so called “smart” actions.

A Smart Environment is an environment which supports the inhabitant in a smart way, so that the user does not notice the technology but just naturally uses it, making its life more comfortable. The smartness in the environment is provided by the interaction of many different smart devices and systems in the environment, which do not act autonomously but exchange data and provide an overall functionality, and by software based on artificial intelligence for controlling the interaction.

Part 1 – Overview, assessment and use of existing technologies in the field of Smart Environments. Lecturer: Prof. Orehek

Short description:
In this part of the course students will learn the basic building blocks of Smart Environments. Starting with the definition of different use-cases in this field, the actual requirements for such systems will be discussed. Knowing and understanding the requirements for Smart Environments different existing technologies found in the field of: internet-of-things, sensor networks, ubiquitous computing, etc., will be introduced and assessed.

The final goal is that students will be enabled to develop, setup and configure an embedded linux platform using a single-board computer (e.g. RaspberryPi, Beagle Bone Black, ...) and different sensors and actors, to create a simple Smart Environment.

Contents
- Definition of a Smart Environment with basic building blocks
- Introduction of different existing technologies
- Assessment of different technologies for Smart Environments
- Setup of a simple Smart Environment using embedded linux, single board computers, sensors and actors
Part 2 – Overview, assessment and use of existing methods for activity recognition and context-aware computing. Lecturer: Prof. Guesgen

**Short description:**
In this part of the course students will learn methods from artificial intelligence relevant to Smart Environments. These methods include logic-based approaches for representing knowledge and reasoning about it, planning algorithms to determine appropriate sequences of actions, formalisms to represent spatial and temporal information, techniques for dealing with uncertainty such as Bayesian networks, decision trees, and neural networks. The methods will be assessed through practical exercises using existing tools.

The final goal is that students are able to select the appropriate methods for a given problem and to apply these methods effectively.

**Contents**
- Use relevant methods for representing knowledge in Smart Environments
- Reasoning about knowledge in Smart Environments, such as methods for activity recognition
- Apply context-information to improve the reasoning process, such as spatial and temporal information

**Prerequisites**
- Basic understanding of electrical engineering (part1: sensors and actors).
- Foundations of computer science and information technology
- Basic programming experience
- Some background in artificial intelligence is of advantage

**Objective of the course/learning outcome**
Students who successfully complete this module will have the answer to the following fundamental questions:
- What are the technologies available to build a Smart Environment?
- What makes a Smart Environment actually “smart”?

Students will be able to:
- Assess the main technologies developed for the internet-of-things to create smart environments
- Adopt existing technologies to setup a simple smart environment.
- Describe the main techniques to create smart environments.
- Use relevant methods for representing knowledge in smart environments and reasoning about it, such as methods for activity recognition.
- Apply context-information to improve the reasoning process, such as spatial and temporal information.

**Recommended reading**
Course material will be provided by the teachers
Assessment methods
Final Exam

Language of instruction
English

Names of lecturers
- Prof. Martin Orehek (FK07) [martin.orehek@hm.edu]
- Prof. Hans Werner Guesgen [h.w.guesgen@massey.ac.nz]