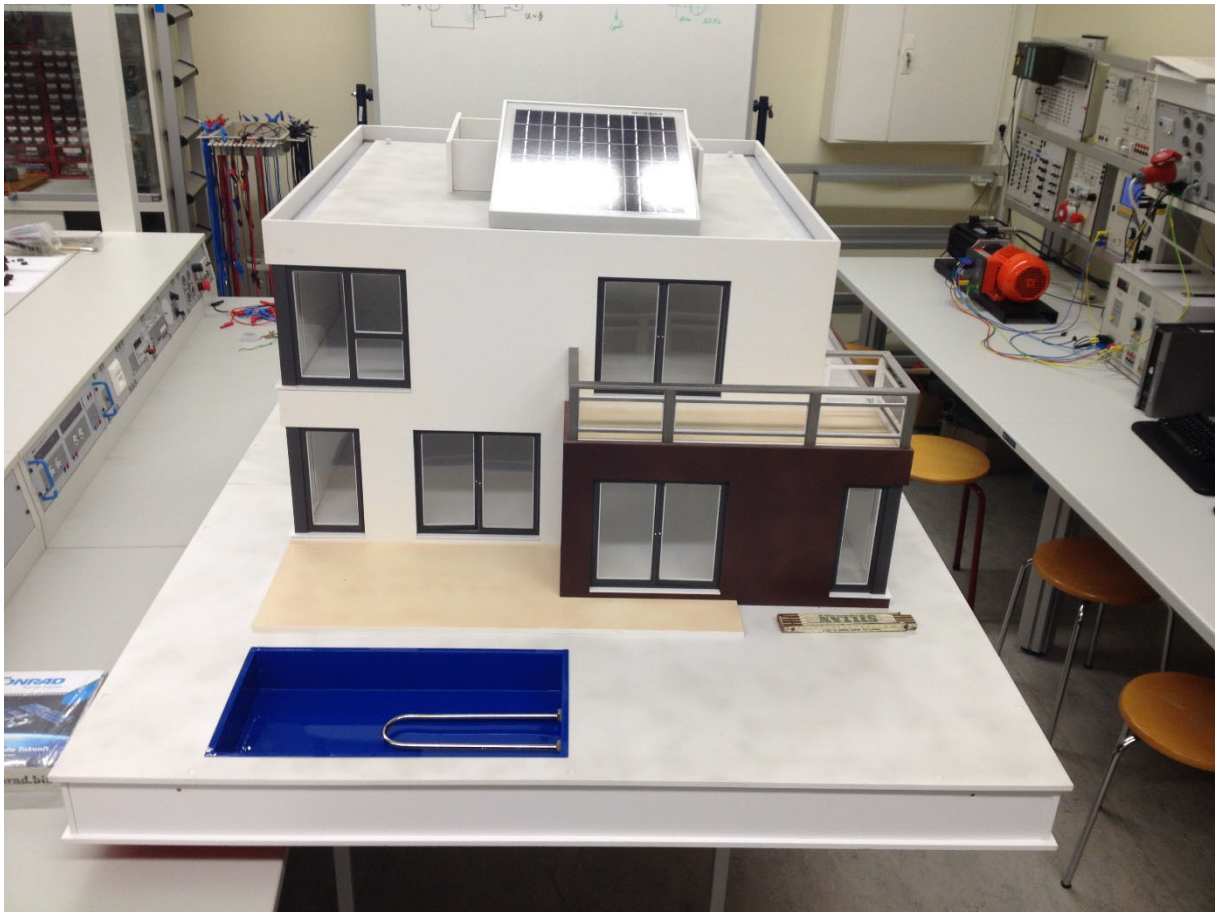
international smart home project

– theoretical part

Course Syllabus



smart home model scale 1:10

Mixed groups of American and German students are working on several topics around a smart home model of a real house. Several tasks can be controlled and monitored by a smart-phone.

Time and Location

This international German-American smart home project will take place from March until September 2020. Time details are listed below and in the 2020 schedule. The syllabus is adjusted to reflect special circumstances related to the international experience. The tabular schedule is a guideline; we will try to follow it closely, but be prepared to adjust to changes in pace dictated by our collective experience.

Timeline 2020:

March until July	assigning of German and American students to the sub-projects selfstudy and long distance groupwork Contact between students via Adobe Connect, Skype etc. Literature research, preparation for sub-projects through self-study
July/August	six weeks in Germany Monday July 6th 2020 – Friday August 16th 2020 at Jade University of Applied Sciences in Wilhelmshaven
August/September	two weeks long distance groupwork, documentation
September	last week final project work at TTU final presentation of the project results at TTU

Instructors

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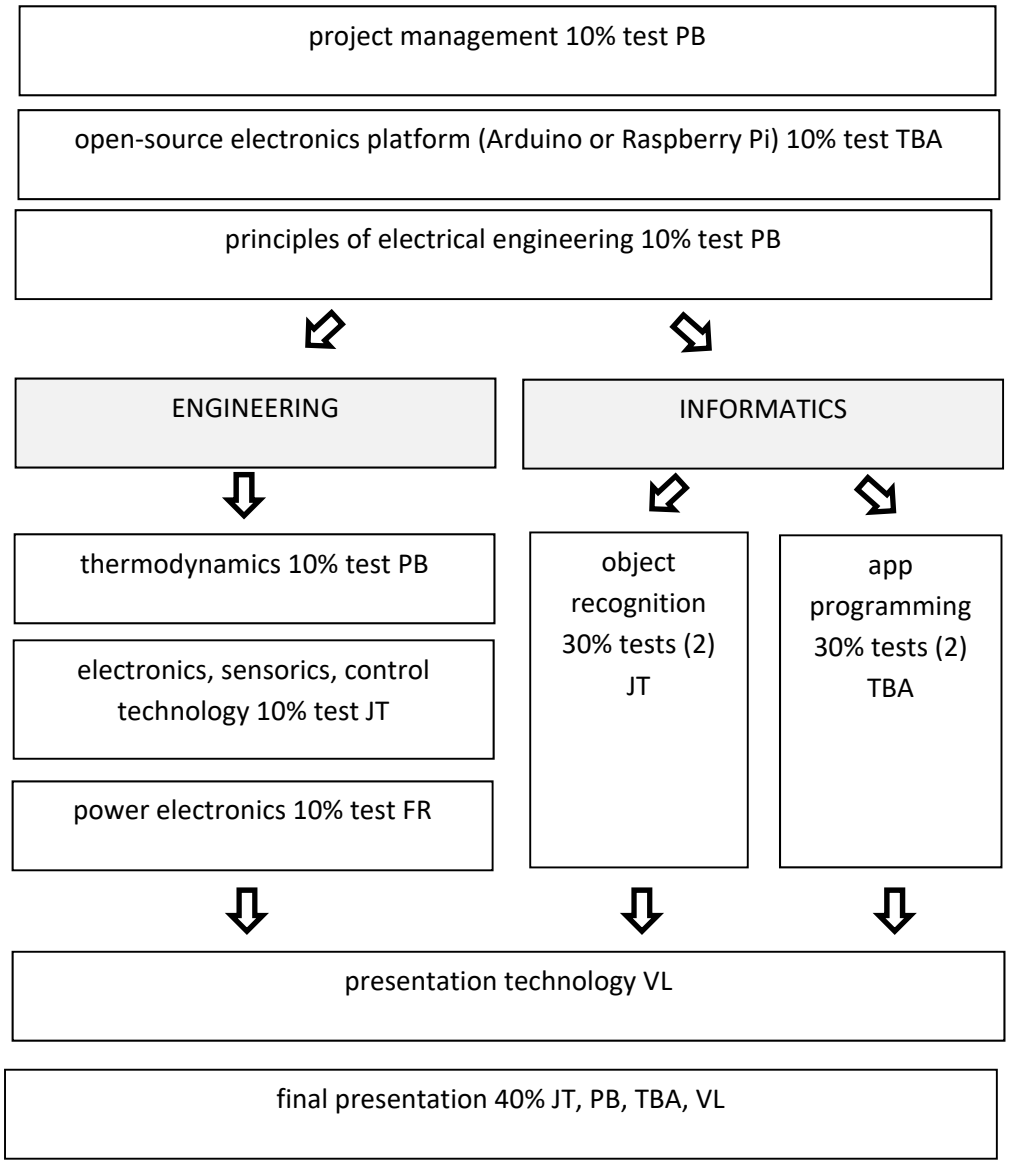
Office Hours

We can meet after each class or lab for questions or on appointment.

The international smart home project consists of two parts:

- **smart home project - theoretical part**
- **smart home project - practical part**

Content of the smart home project - theoretical part



Content of the smart home project – practical part

Sub-projects, student chooses one out of five:

A: heating pool

prerequisite:
smart home project - theoretical part - branch ENGINEERING

B: app development

prerequisite:
smart home project - theoretical part - branch INFORMATICS

C: elevator

prerequisite:
smart home project - theoretical part - branch ENGINEERING

D: photovoltaics

prerequisite:
smart home project - theoretical part - branch ENGINEERING

E: optical movement and shape recognition

prerequisite:
smart home project - theoretical part - branch INFORMATICS

This syllabus is for the **international smart home project - theoretical part!**

Catalog Description and Prerequisites

American and German students will participate in an international project. The theoretical part is divided in several parts. Mixed student groups are attending the classes. Which classes the student has to to attend is depending on the branch and the sub-project he will work on.

Prerequisites: none.

All students have to attend the classes:

- **project management**

  description:

  - Definition, Standards and procedural models
  - Project planning
  - Project monitoring and control
  - Project completion
  - Project documentation

- **open-source electronics platform (Arduino or Raspberry Pi)**

  description:

  - introduction in programming Arduino or Rasperry PI
  - different programming exercises in the lab of Computer Science
  - using tools and libraries
  -

- **principles of electrical engineering**

  description:

  - current- and voltage sources
  - Characteristics of different sources (Battery, PV-Panel,…)
  - Graphic display of characteristics and operation points
  - Electric energy and power
  -

- **presentation technology**

  description:

  - effective presentation
  - target the audience effectively
  - research, plan and prepare professionally
  - free from mistakes

- short messages
- clear, not too detailed pictures and diagrams
- deliver the right message on every slide
- use the right design
- correct, from far away readable letter size
- avoid unnecessary messages
- practice the presentation in the room
- what is to do if the presentation equipment does not work
- do not loose time
- standing and presenting
- handout, download option

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The next topics are depending on the selected sub-projects:

ENGINEERING

branch for sub projects "heating pool", "elevator" and "photovoltaics"

- **thermodynamics**

  description:

- common laws in the field of thermodynamics
- measure electrical power and heat (different practical exercises in the lab of Physics)
- kinds of heat transfer, heat transmission
- calculation of heat transfer coefficient and temperature gradient
- mathematical models of a control path (f.e. heated pool)
-

- **electronics, sensorics, control technology**

  description:

- PTC, NTC, non linear devices
- Operational amplifiers and circuits
- Diff. industrial sensors (magnetic field sensor, ultrasonic sensor, light barrier, …)
- Operation and control
- P-, PI,-PID-Controller – parameter settings
- introduction in MathLab

- **power electronics**

  description:

- phase angle control, zero voltage switches,
- diff. amplifier circuits
-

INFORMATICS

branch for "app development" and ,"optical movement and shape recognition"

- **object recognition**

description:

- Hough transformation
- Sobel filter
- Approximation of image gradients
-

- **app programming**

description:

- fundamentals
- interfaces and scripts
- design of the menu
- user interface elements
- Implementation of graphic elements (dynamic coordinate system,…)
-

Textbooks

Lessons In Electric Circuits, Volume III – Semiconductors; Tony R. Kuphaldt; Fifth Edition, last update March 29, 2009

Control Engineering – A guide for beginners; Manfred Schleicher, Frank Blasinger (free)

Machine to Machine - Protocols:

AMQP: https://www.youtube.com/watch?v=ODpeIdUdClc

MQTT: https://www.youtube.com/watch?v=EH3GOzKvdZw

Arduino / C Programming:

https://playground.arduino.cc/uploads/Main/arduino_notebook_v1-1.pdf

Purpose

In this project, students can apply their theoretical knowledge acquired in their previous studies. With this and some new theory they realize a sub-project of a smart home project. They work together in small groups of American and German students. The solution is a functional device and/or software.

Objectives - learning outcomes

After that project part students should be able to:

- work in international groups of different cultures.
- do literature research on a previously unknown subject.
- communicate over a long distance via multimedia.
- apply their previous knowledge and new features to a **theoretical** result.
- realize a project with concept phase, executing phase and presentation.
- do first project management.
- have first experience in programming smart phones and single board computers.
- write a project documentation.
- present their results in front of an audience

Course Schedule

Look at separate schedule of the project!

Assessment Instruments

There will be short written tests after each theoretical class. The grading percentage is depending on the selected branch. The project ends with the final presentation at TTU.

Grading Policy

Final grade is determined based on tests and final presentation. Letter grades will be assigned using University standards The approximate weighting of graded material in determining the final grade is as follows:

Item	**Percent of Grade**
Tests	60 %
final presentation	40 %

Grades will be provided latest 2 weeks after the end of the project.

Academic Misconduct

Cheating, plagiarism and academic dishonesty will not be tolerated.

Disability Policy

"Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructors office hours. Please note instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office at TTU 335 West Hall or 806- 742-2405.