TU Clausthal

Institute for Software and Systems Engineering

IoT and Digitalization for the Circular Economy

Lecture 0: Organization

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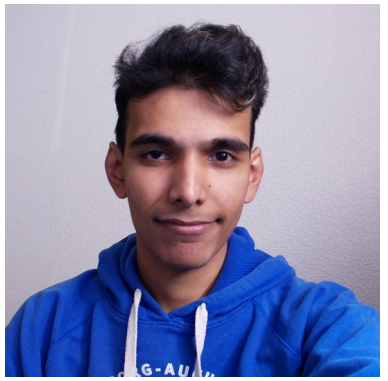
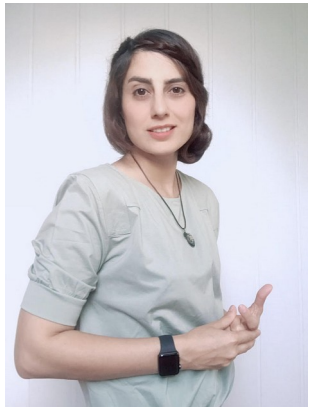
- Updated versions of these slides will be available in our Github repository.

Team

Prof. Dr. Benjamin Leiding



M.Sc. Anant Sujatanagarjuna



M.Sc. Shohreh Kia

Research Group

- **E**merging **T**echnologies for the **C**ircular **E**conomy → **ETCE**
- Research focus:
  - Intersection of IT and sustainability
  - Circular Economy and Circular Societies
  - Self-organized, decentralized and distributed systems
  - Sustinable and resilient food production
- Other courses:
  - Requirements Engineering (WS – M.Sc.)
  - The Limits to Growth – Sustainability and the Circular Economy (WS – open for everyone)

Research Group

- ETCE Website – Link
  - Course material
  - Theses/project topics

- Our research in action:
  - ZDF documentary (German) – Link
  - Klartext Preis 2020 (German) – Link

Learning Outcome

- Understanding the concept of a circular economy, sustainability, and related concepts (biocapacity, etc.).
- Gain a basic understanding of causes, dimensions, and the characterization of climate change, environmental pollution, and dwindling non-renewable resources.
- Introduction to IoT and cyberphysical systems in the circular economy
- Sensors and actuators for IoT, control and process systems of the circular economy
- Experience in prototyping IoT applications and systems
- The ability to critically assess upcoming technological solutions enabling/facilitating sustainability and the circular economy.

Lectures

- 15.04.2024 → Organization (L00) + Introduction (L01)
- 22.04.2024 → Circular Economy (L02)
- 29.04.2024 → Lifecycle Assessment – LCA (L03)
- 06.05.2024 → Introduction to the Internet of Things (L04)
- 13.05.2024 → Internet of Things – Communication + Security and Privacy (L05)
- 27.05.2024 → Internet of Things – Data Processing and BigData (L06)
- 03.06.2024 → Industrial Internet of Things (L07)

- **10.06.2024 → IoT in Mining I (L08)**
- **17.06.2024 → IoT in Mining II (L09)**
- **24.06.2024 → Technologies for Sustainability – MOOC Content (L10)**

- **02.07.2024 → Coding Workshop I (Goslar)**
- **04.07.2024 → Coding Workshop II (Goslar)**

- **15.07.2024 → Exam Q&A**

Exercises

- 15.04.2024 → Exercise 01 – Carbon Footprint
- 22.04.2024 → Exercise 02 – Circular Economy
- 29.04.2024 → Exercise 03 – LCA
- 03.06.2024 → Exercise 04 – Industrial IoT
- 17.06.2024 → Exercise 05 – IoT in Mining
- 24.06.2024 → Exercise 06 – Technology Assessment

Course Organization

- News and updates → StudIP

- Organization of the lecture:
  - Slides are available on Github (Link)
    - Please report bugs!
  - Lectures and exercises as live stream (BBB – next slide)
  - Lecture recordings will be available on StudIP and on Github
  - Exercise time slots = Time for questions and eventual tutorials related to the exercises

Questions? Write us an email: etce-iot@tu-clausthal.de ← **We will only respond to emails written to this specific email address!**

Dates/Times/Locations

- Lecture:
  - Monday **2:15 pm to 3:45 pm** (Berlin time) – **15.04.2024** to **04.07.2024**
  - Location: Goslar Gotec (Am Stollen 19 C, 38640 Goslar, Germany) or via BigBlueButton (Link) **OR video recordings**

- Exercise / Q&A:
  - Monday **4 pm to 5 pm** (Berlin time) – **15.04.2024** to **24.06.2024**
  - Location: Goslar Gotec (Am Stollen 19 C, 38640 Goslar, Germany) or via BigBlueButton (Link)

- Practical Coding Workshop:
  - When: **02.07.2024 and 04.07.2024** from **9 am – 4 pm (Berlin time)**
  - Location: Goslar (DIGIT)

Exercises and Practical Workshop

- Individual work → no group submissions
- Submission of **each** exercise is **mandatory**
- You pass by submitting an exercise – *even if it is an empty page*
- You will receive feedback on your submission (during Q&A session)
- Exercise = learning feedback
- Practical workshop → You pass the workshop if you score 50% (or more)

Examination

- Prerequisite for admission to the final exam (all criteria have to be fulfilled):
  - Submit all exercises
  - Pass the practical workshop

- Final exam:
  - **Most likely 25.07.2024 and 26.07.2024**
  - Oral examination (20min)
  - Online

Self-Study Star

Self-Study Star → 

- Slides with the self-study star indicate optional/additional study material that is **not** mandatory but could be helpful or interesting

Literature

- This course is not based on a single book and you **do not** need to buy a book to pass the exam.

- Donella H. Meadows, Jorgen Randers, and Dennis L. Meadows. *The Limits to Growth* (1972).
- Donella H. Meadows, Jorgen Randers, and Dennis L. Meadows. *Limits To Growth: The 30-Year Update* (2004).
- Baccini et al. *Metabolism of the Anthroposphere: Analysis, Evaluation, Design* (2012).
- Walter R. Stahel. *The Circular Economy: A User's Guide* (2019).
- W. Brian Arthur. *The Nature of Technology: What It Is and How it Evolves* (2011)

Literature

- Perry Lea. Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security (2018).
- M.A. Khan, M.T. Quasim, F. Algarni, A. Alharthi. *Decentralised Internet of Things* (2020).
- Dimitrios Serpanos und Marilyn Claire Wolf. *Internet-of-Things (IoT) Systems Architectures, Algorithms, Methodologies* (2018).

Questions?