ERASMUS Teaching Mobility at UPC

**Seminar „Environmental Sustainability in Software Engineering“**

The rapid development of information and communications technology (ICT) is contributing a fair share to excessive exploitation of resources by improving our working capabilities by orders of magnitude during the past century. On the other hand, ICT also bears a lot of potential for “greening through IT”, which would improve the environmental sustainability of humankind, but this is yet not fully explored in research.

ICT systems are amongst our most effective means to change how we interact with the world around us. These changes occur at a high rate and in shortening innovation cycles. This emphasis on short-term impacts draws the focus for many individuals and institutions away from long-term environmental well-being. Thus, ICT systems as they are currently deployed in society often serve as distractions from more important but less urgent long-term issues.

Consequently, for using the potential of ICT to change human interaction with the world towards more sustainable behaviour, sustainability should be made a first class quality demand in software engineering.

“Greening through IT” involves using what we have learned in information technology and related disciplines to make our life “greener” (in the sense of more environmentally sustainable) by providing adequate technological support for the actions of our daily life; this is the context of our proposed research.

The challenge is to analyse how to reduce man’s impact on the environment by finding new approaches in ICT that explicitly take sustainability into account. We call these systems “ICT for environmental sustainability” and abbreviate them with ICT4ES. Our aim is to support the development of ICT4ES with an adequate software engineering approach that integrates the knowledge of environmental informatics.

**Goals**

The learning goals for the seminar are:

- Develop an understanding of what sustainability is
- Get an overview of what aspects contribute to sustainability inside and outside of software engineering
- Perform an assessment of already existing work in the area
- Develop an overview of open challenges and issues
- Understand how sustainability can be supported within requirements engineering
- Know possibilities to support the analysis of sustainability

**Outline**

The extent of the seminar is two weeks with 6h of presence per week at class with lecture and active participation in group work, followed by a homework phase with a written essay to be handed in 4-6 weeks later.

- Phase 1: Week with three sessions of 2 hours, each including 45-60 min lecture and 30-45 min discussion and group work
- Phase 2: Week with three sessions of 2 hours, each including short presentations by the students followed by discussion and group work
- Phase 3: Home elaboration of a written essay on an agreed specific topic with an assessment of related literature and analysis of potential future work and solutions.
- Phase 4: Mutual feedback for students and lecturer and assessment of the seminar and its results.
**Topics**

1. **Systematic Literature Review of ICT4ES.**
   Analysis with setup and complete protocol according to Kitchenham 2009.
2. **Survey of Potential ICT4ES Systems and Classification of Domains.**
   Which domains are relevant for ICT4ES and how to classify them?
3. **Interview Study with Practitioners on Values behind Sustainability.**
   Which stakeholders have a direct interest in sustainability and what are their values?
4. **Survey of Goals for Sustainability and their Classification.**
   What are the goals for supporting sustainability and how to classify them?
5. **Survey of Metrics for Sustainability and their Applicability to Software.**
   What are the KPIs in use for environmental sustainability and how to apply them to software?
6. **Suitability of Domain Modelling Techniques.**
   Which modelling techniques in Software and in Environmental Sciences are suitable to perform domain modelling for ICT4ES?
7. **Suitability of Artefacts for Sustainability Requirements.**
   What documentation artefacts are suitable to elicit and capture sustainability requirements?
8. **Suitability of Life Cycle Analysis to an ICT4ES System.**
   How to apply Life Cycle Analysis for the impact of a software system's usage processes?
9. **Suitability of Risk Assessment Techniques for an ICT4ES System.**
   How to apply risk assessment techniques for environmental sustainability?
10. **Suitability of Impact Analysis Techniques for an ICT4ES System.**
    How to apply impact analysis techniques for environmental sustainability?

> For the suitability topics, all students use the same case study in the domain of eMobility – this case study combines information systems and embedded systems and includes direct user interaction as well as background processes.

**Rules**

- You can always ask! (también en castellano)
- Proper research work (search, sources, citations, references, writing style)
- Intended for publication
- Make your presentation as interactive as possible
- Let audience participate instead of lecturing them
- Homework of 5000 words +/- 10%, use graphics for illustration