Abstract

This is the homework for a course for bachelor students in systems engineering for the part architectural reasoning.
Monday January 21, 12:00 lecture, 13-16 class work

Thursday January 24, 10:00 lecture, 11-15 class work

Thursday February 7, submit homework 1

Monday February 18, 12:00 lecture, 13-16 class work

Thursday February 21, 10:00 lecture, 11-14 class work

Monday March 11, submit presentation of homework 2

Monday April 8, submit individual reflection report of homework 2
Specify and design

an autonomous waste collector.

This collector finds and removes waste from the environment.
Use time-boxes of 15 minutes and perform the following steps:

- Sketch the system-of-interest and its immediate context
  - Annotate the sketch (e.g. main components, interfaces, functions, …)
- Draw an initial design
- Make a specification of the system-of-interest (view it as a blackbox)
  - What functionality, performance, interfaces, standards or regulations
- Identify the main customer stakeholders and their concerns
- Identify the main life cycle stakeholders and their concerns
- Review and make a plan to consolidate in a presentation
1. sketch the system-of-interest and its context
2. draw an initial design
3. make a specification
4. identify customer stakeholders
5. identify life cycle stakeholders
Start second iteration by elaborating FCR views

Use time-boxes of about 30 minutes

- Decompose the system in subsystems, decompose one subsystem in subsubsystems.
  - Show the subsystems and interfaces in a block diagram
- Make a functional model of the internals of the system-of-interest
  - Use one or more diagrams to show the dynamic behavior
- Define 5..10 Key Performance Parameters of the system-of-interest
  - Define a use case to support the definition of KPPs
- Make a technical budget for one of the key performance parameters
- Review and make a plan to consolidate in a presentation
Class-work Day 2 mapped on CAFCR

- **C**ustomer objectives
- **A**pplication
- **F**unctional
- **C**onceptual
- **R**ealization
- **L**ife cycle

1. sketch the system-of-interest and its context
2. draw an initial design
3. make a specification
4. identify customer stakeholders
5. identify life cycle stakeholders
6. partitioning and interfaces
7. make functional design
8. define key performance
9. make performance budget

Bachelor Course Systems Engineering: Architectural Reasoning; Homework
version: 1.5
January 21, 2019
Gerrit Muller
Homework after Day 2

Transform your results in electronic form (e.g., PowerPoint or Visio)

Develop two alternative solutions/concepts

Compare the three solutions using a Pugh matrix

- define 5..10 criteria for comparison
- score the solutions on a scale from 1 (poor) to 5 (very good)

Make a list of questions triggered by the first iteration

Search for facts to ease the next class-work
Homework instructions

presentation

filename: BSEAR team<your teamnumber> homework<number>

e.g. BSEAR team1 homework1.ppt

all team members on front page

e-mail to: <gerrit.muller@usn.no>

cc: Jamal

subject: homework BSEAR team<your teamnumber> homework<number>

from/cc: <all email addresses of team members>
Continue second iteration by elaborating CA views

Use time-boxes of about 40 minutes

- Develop a story that helps you to understand the customer better and that facilitates analysis of specification and design
  - Verify your story against the story criteria
- Develop a customer key driver graph
  - Start with Key Performance Parameters and ask “why (is this needed)” repeatedly.

Use time-box of about 20 minutes for the remaining task

- Make a context diagram
1. sketch the system-of-interest and its context
2. draw an initial design
3. make a specification
4. identify customer stakeholders
5. identify life cycle stakeholders
6. partitioning and interfaces
7. make functional design
8. define key performance
9. make performance budget
10. develop 3 alternate solutions
11. determine 5..10 criteria for comparison
12. rank 3 alternate solutions against criteria
13. Make a Story
14. Customer Key Driver Graph
15. Context diagram
Continue second iteration by elaborating life cycle view

Use time-boxes of about 30 minutes

- Develop a business plan for your company
  - determine your role in the value chain
  - determine income, expenses, and investments
  - estimate cash flow as function of time
- Identify needs and concerns from life cycle stakeholders
  - determine life cycle key drivers and key performance parameters
- Make a Cost of ownership estimate for customers
  Use time-box of about 20 minutes for the remaining task
- Make a schedule for development and start of deployment
Class-work Day 4 mapped on CAFCR

1. sketch the system-of-interest and its context
2. draw an initial design
3. make a specification
4. identify customer stakeholders
5. identify life cycle stakeholders
6. partitioning and interfaces
7. make functional design
8. define key performance
9. make performance budget
10. develop 3 alternate solutions
11. determine 5..10 criteria for comparison
12. rank 3 alternate solutions against criteria
13. develop a story
14. Customer Key Driver Graph
15. Context diagram
16. Make business plan
17. needs and concerns
18. Cost of Ownership model
19. Schedule
20. check specification and design for major gaps or improvements
T-shaped Presentation

- Societal trends
- Opportunities
- Problems
- Needs

- Business/market competition trends
- Opportunities
- Problems
- Needs

- Customers stakeholders
- Key drivers
- Concerns
- Applications

- Product project system
- Functions
- Key performance

- Design and concepts
- Functional, physical
- Quantified

- Specific aspects
- Functional, physical
- Quantified

- Technology
- Critical or new

Summary how solution answers needs

Conclusions and recommendations

Why choices are appropriate

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Check specification and design for major gaps or improvements

Transform your results in electronic form (e.g., PowerPoint or Visio)

Make a T-shaped presentation for your management; its main purpose is to take a go/no-go decision

Write an individual reflection report, max 2 A4s:

What are your main learning points?

What aspects deserve most attention in next phase of your project? Explain why.
Specify and design an autonomous track/road maintainer for elderly Norwegians.

This robotic vehicle, amongs others, keeps the drive to their home fully operational (in winter).
Specify and design an Unmanned Humanitarian Response/Support Vehicle,
which will be able to reach locations with poor, bad, or destroyed access.
Specify and design a full-electric TukTuk 
(versatile, urban, no emission)

http://en.wikipedia.org/wiki/Auto_rickshaw#mediaviewer/File:DKoehl_colombo_auto_rickshaw.JPG
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Specify and design a full-electric drive-by-wire race kart