Abstract

This is the homework for a course for bachelor students in systems engineering for the part architectural reasoning
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday January 23</td>
<td>10:00 lecture, 11-15 class work</td>
</tr>
<tr>
<td>Thursday January 26</td>
<td>10:00 lecture, 11-15 class work</td>
</tr>
<tr>
<td>Friday February 10</td>
<td>submit homework 1</td>
</tr>
<tr>
<td>Monday February 13</td>
<td>10:00 lecture, 11-15 class work</td>
</tr>
<tr>
<td>Thursday February 16</td>
<td>10:00 lecture, 11-15 class work</td>
</tr>
<tr>
<td>Tuesday February 28</td>
<td>submit presentation of homework 2</td>
</tr>
<tr>
<td>Tuesday April 4</td>
<td>submit individual reflection report of homework 2</td>
</tr>
</tbody>
</table>
Specify and design a **Drone Interception System**.

The goal is to prevent drone misuse, e.g. paparazzi's, terrorist attacks, etc.

You may determine your own scope, such as clients, location, and application e.g., celebrities, festivals, oil companies

- Kongsberg
- Viken
- Norway
- Europe
  - e.g., security
  - counterintelligence
Company: start-up

- Each group is a **start-up company**; you are its **management team**

- You have **investors** that are **funding** you in the first phase

- At the **end of the spring**, the investors will decide on further funding

- You have to build a **presentation** with a **proposal** for the next phase, such that you **convince the investors** to fund the next phase
Allocate your roles

Project Leader (organization, process)
- planning
- progress control
- resource management
- risk management
- project log

Systems Engineer (content)
- system specification
- system design
- system integration
- fitness for purpose

Experts (content, doing)
- part & function specs
- part & function design
- analysis
- build
- test

Marketing (sales, external contacts)
- customer contacts
- pricing
- market positioning
- business model
- options
Be Aware of the Team Dynamics

Forming
- unclear purpose
- polite
- needs strong guidance

Storming
- more purpose
- conflict
- needs guidance

Norming
- agreement
- roles
- facilitating

Performing
- clear vision
- goal achievement
- delegation

after http://www.mspguide.org/tool/tuckman-forming-norming-storming-performing
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
Class-work Day 1 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
# Class-work Day 2: Elaboration

<table>
<thead>
<tr>
<th>Start second iteration by elaborating FCR views</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use time-boxes of about 30 minutes</td>
</tr>
</tbody>
</table>

- 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

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
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)
  - recommend a solution with a rationale
- Make a list of questions triggered by the first iteration
- Search for facts to ease the next class-work
- Submit as draft presentation via Canvas
Homework instructions

presentation

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

    e.g. BSEAR team1 homework1.ppt

all team members on front page

upload homework to Canvas

Questions email to: <gerrit . muller@usn . no>

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
### Class-work Day 3 mapped on CAFCR

<table>
<thead>
<tr>
<th>Customer objectives</th>
<th>Application</th>
<th>Functional</th>
<th>Conceptual</th>
<th>Realization</th>
<th>Life cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. sketch the system-of-interest and its context</td>
<td>2. draw an initial design</td>
<td>3. make a specification</td>
<td>4. identify customer stakeholders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. identify life cycle stakeholders</td>
<td>6. partitioning and interfaces</td>
<td>7. make functional design</td>
<td>8. define key performance</td>
<td>9. make performance budget</td>
<td></td>
</tr>
<tr>
<td>10. develop 3 alternate solutions</td>
<td>11. determine 5..10 criteria for comparison</td>
<td>12. rank 3 alternate solutions against criteria</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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
- Business/Market competition
- Customer needs
- Product project system functions
- Design and concepts functional, physical quantified
- Specific aspects functional, physical quantified
- Technology critical or new
- Summary and conclusions why choices are appropriate
- Conclusions and recommendations
- Why solution answers needs
- Summary how solution answers needs
- Risk analysis
- Business quantification
- Key performance concerns
- Stakeholders key drivers applications
- Business trends opportunities problems needs
- Business trends opportunities problems needs
- Competition trends opportunities problems needs
- Effects on societal needs

Bachelor Course Systems Engineering: Architectural Reasoning; Homework

version: 1.9
February 6, 2023
SEMAPresentationTshape
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, covering all 4 days; its main purpose is to make an initial go/no-go decision

Submit this presentation via Canvas

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.

Submit this individual reflection report via Canvas
Specify and design

a **Smart Covid Test Collecting and Handling System**.

The goal is to achieve good and actual insight in infections.

You may determine your own scope, such as clients, location, and application:

- e.g., Kongsberg, Viken, Norway, Europe
- e.g., screening, diagnosis, monitoring, tracing
- e.g., children, employees, or elderly
Specify and design a **Smart Waste System**.

The goal is to achieve sustainability, where resources are fully recycled.

You may determine your own scope, such as type of waste, location, and application

- e.g., plastic
- e.g., metal

- e.g., Kongsberg
- e.g., residential
- e.g., industrial
- e.g., agricultural
Specify and design

a Smart and Sustainable, e.g. energy neutral etc., House or Building for Norway,

which will be comfortable, attractive and affordable
Specify and design an autonomous waste collector.

This collector finds and removes waste from the environment.
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
by Dan Koehl, license: http://creativecommons.org/licenses/by/3.0/
Specify and design a full-electric drive-by-wire race kart