Embedded Software Engineering
Homework/Semester Project

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Task 1 (Done)
► Build a team with 3-5 persons

Task 2 (done)
► The characteristics of Embedded Systems are:
   ► Reactive systems
   ► Real-time systems
   ► Continuous/discrete/hybrid systems
   ► Dependable systems
   ► Distributed systems
► Find examples in at least three application domains (e.g. automotive, transportation, space mission)
   ► Explain the different characteristics by these examples in detail
      ► These includes details of the characteristics like (note: this not a complete list): How are the attributes of dependability addressed (e.g. which safety standard)

▶ Design a "Smart City" system with an appropriate tool

  ▶ Basic use case: networked traffic control for autonomous cars.

  ▶ e.g. eclipse papyrus, enterprise architect

▶ Start with the specification of the analysis model in SysML

  ▶ Specify at least 10 requirements

  ▶ Define the context / use cases of the system

    ▶ Refine three use cases with activity diagrams

  ▶ Based on this, define the analysis architecture (Context Diagram) with block diagrams (at least 10 blocks) and describe the main interaction with the environment with sequence diagrams

  ▶ Discussion during next session

▶ Specification of the analysis model in SysML

   ▶ Constraint the system with parametric constraint diagrams (at least 5 constraints)

   ▶ Allocate the diagrams to each other in an allocation diagram

▶ Based on the analysis model derive a design model

   ▶ Refine the architecture (block diagrams) with the help of internal block diagrams (add at least 5 blocks)

   ▶ Define the behavior with state machines of at least 3 components

      ▶ Show / argument that the state machine behavior fulfills (refines) the interaction behavior (as modeled in the analysis phase)

   ▶ Show partly the implementation level of one block including the state machine behavior

      ▶ Including the mapping to prototype Hardware (Arduino, Raspberry P, tinkercad)

      ▶ Mapping should be done in a structured way

         ▶ Blocks

         ▶ State machines, …

► Brake down the specified requirements to the level of scheduling

  ► Define (test or analysis) the computation time (worst case) of the tasks of the component you implement

   ► Use pyCPA (https://pycpa.readthedocs.io/en/latest/) – if possible or calculate the wcet via knowledge of the hardware

  ► Specify all scheduling constraints based on the requirements

► Show that the implemented component with its set of tasks is scheduable (EDF or RMS or both).

▶ Inspection

- ▶ All team members have to do one inspection of a document (Model, source code, …) of an other team member
  - ▶ E.g. Team member A developed the requirements and team member B inspects the requirements
- ▶ Documentation of inspection
  - ▶ Describe shortly the inspected document including the review
    - ▶ Positive and negative points
    - ▶ Negative points should have influence of an updated version of the document

▶ Testing

- ▶ Define and execute 5 unit tests as validation tests
  - ▶ E.g. use the Junit or Cunit Framework
  - ▶ Show the relation / trace to the requirements
- ▶ Define at least 5 defect test
- ▶ Define and execute 3 component / interface tests of the implemented block
- ▶ Implement a component/block in a test driven based way

▶ Students get access via vpn (https://intranet.fh-dortmund.de/de/hs/hit/service/vpn/vpn-start.php)

▶ After installing

▶ Enterprise Architect, the following path must be accessed:

▶

▶ \eafl-share.idial.fh-dortmund.de\lic

▶

▶ Username: student

▶ Password: gZjtnQq9TPK9xgCm

▶

▶ In the folder is the file sskeys.dat, the users must then choose

▶ a free license once they have selected the file in EA.

▶

▶ For completeness the whole path (I'm not sure if EA needs the whole path or just the folder).

▶ needs the whole path or just the folder)

▶

▶ \eafl-share.idial.fh-dortmund.de\lic\sskeys.dat

▶ Start a vpn connection via

- ▶ https://intranet.fh-dortmund.de/de/hs/hit/service/vpn/vpn-start.php

▶ Download and install ea

- ▶ file://eafl-share.idial.fh-dortmund.de/sw

▶ Start ea

- ▶ Add a shared key
  - ▶ Type in the path: \\eafl-share.idial.fh-dortmund.de\lic
  - ▶ Select one of the licences
  - ▶ See for details file:
    - ▶ "EAFloatingLic.pdf"

▶ .. If not working, use test version