

Specification of embedded systems

Problem Quadcopter

Available: A quadcopter is under development¹. It can lift, but cannot fly!



Your task is to plan how it can be further developed to meet the following requirements:

1. It shall be operated via the available remote control but be able to fly.
2. It shall be able to fly autonomously, i.e. independently without remote control.

Try to think of all possible problems we can have to realize this embedded system. The goal is to write a detailed specification of the system and describe the system with software and hardware architectures. This result is to be presented in a report (individually written). The report is intended to be used for software and hardware design of the quadcopter. The report is to guide the hardware and software teams in developing the quadcopter.

The task is to be carried out using the seven steps (see next page) for the PBL² model.

Meeting #1: Carry out the steps 1-5.

Individually: Step 6.

Meeting #2: Step 7. At this meeting you should be able to present and discuss the draft of your report.

Deadlines Hand in your reports to Bilda (www.bilda.kth.se).

Draft 2013-01-28 no later than 09.00 (requirement to participate in meeting #2)

Final report 2013-02-18 no later than 09.00

Grading criteria

The final report is assessed with grade points 0, 1, 2 or 3

0 means the report has not passed, might be possible to upgrade to 1 point but no more

1 fulfills basic requirements to specify the system

¹ Se Projektrapport Quadcopter och Produktbeskrivning Quadcopter

² PBL: Problem Based Learning

- 2 shows good understanding of problems and good description of specification and architectures
- 3 shows very good understanding of problems and very good description of specification and architectures, discussion and evaluation on different ways to solve the problems, deep understanding of problems that will arise when implementing hardware and software

To get points corresponding to higher level you have to fulfill all lower levels

The seven steps of problem based learning

<p><i>step 1 Making the case clear</i></p> <ul style="list-style-type: none"> - Are there any words that you don't understand? - If the case is a picture, does everyone agree on what it is?
<p><i>Step2 Frame/ formulate questions and queries</i> (The secretary must write down every question on the blackboard or whiteboard)</p> <ul style="list-style-type: none"> - What is the illustration (case) about, what is the essence/most important aspect of the illustration? - Frame questions about the topic. Brainstorm about the topic. How...? What...? Why...? - select similar questions, group them together and label them
<p><i>Step 3 Develop ideas about the questions. Brainstorm!</i></p> <ul style="list-style-type: none"> - What kind of ideas and notions do the group-members have on the questions that were formulated during step two? - Use your current knowledge and experience - Do not evaluate the different suggestions - Write or draw models on the blackboard (if it does not stop the flow of ideas)
<p><i>Step 4 Structure the idea</i></p> <ul style="list-style-type: none"> - Which ideas belong together - Make choices from the ideas and fantasies ; decide what the group wants to develop further.
<p><i>Step 5 Formulate learning-goals for the group-members</i></p> <ul style="list-style-type: none"> - Formulate common learning-goals from the results of step four - It is important that everybody in the group agrees on these. - The learning-goals should be attainable by the next group meeting, the goals must be relevant to the course being studied.
<p><i>Step 6 Self-directed learning</i></p> <ul style="list-style-type: none"> - Search for extra knowledge on the learning-goals that you formulated in step 5 - Everyone's knowledge on the topic should deepen - It is the responsibility of everyone to obtain knowledge and information on the topic - Lectures, experiments or other kind of teaching-methods may support the self-directed learning
<p><i>Step 7 Integrate all ideas into one problem area</i></p> <ul style="list-style-type: none"> - Everybody in the group describes <i>how</i> they found the knowledge or information - One or two in the group describe what they found - Everybody participates in the phase of discussion, analysing, inquiring and evaluating his or her knowledge. - It is possible that the group may want to develop ideas further and formulate new problems within the topic to increase knowledge