Course analysis (2013/14 period 1+2)
DD2425 Robotics and Autonomous Systems, 9hp

Course responsible and lecturer: Patric Jensfelt
Lab assistants: Francisco Vina, Alejandro Marcinotto and Johan Ekekrantz (lab)
Number of lectures: 12 lectures (24 hours)
Registered students: 46 (according to VIS, but it was really only 45)
"Prestationsgrad": 94%
"Examinationgrad": 91%

Course material:

- Book: "Introduction to Autonomous Mobile Robots" by Roland Siegwart and Illah R. Nourbakhsh published by the MIT Press.
- Lecture notes: Available for download from BILDA

Examination requirements:

- LAB1 0.5hp (during first period)
  - Basis ROS assignment
- TEN1 3hp (after course)
  - Written exam (re-exam Dec 2013)
- PRO1 5.5hp (whole second period)
  - Project work
  - Weekly status reports from the project group
  - Presentation
  - Reflection on the work of oneself
  - Reflection on group work
  - Project report

General description:
The course runs over two periods with the first period providing an overview of the field of robotics and the second being entirely focus on a project. This year the project work was started already in the first period although at a lower pace. The project takes a lot of time. The course was appreciated by all students (71% very interesting and 29% interesting).

Grading:
Grading is based on a weighted average of the score from the project (50%) and exam (50%) which both give a score between 0 and 10 where 0 is just passing and 10 is the maximum score. The score in the project is individual but the group collects points together.

Relation to the previous years:

Lecture: The task that was used as a lab last year was now done during a lecture.

It worked quite well. One of the double lectures that were schedule was used for this.

Lab: The manipulation lab was replaced with an individual lab on ROS. The idea was to make sure that everyone had the basic skills in ROS. It was not well defined enough which led to us having to accept less than we wanted to accept which in turn meant that it did not quite serve its purpose.

Computer hardware: Major change in hardware. Now using Intel NUC as the main platform and Arduino Mega 2560 rev3 together with an Arduino Motor Shield rev3 and a custom made connection and power board. The latter was the first prototype and had some problems as they could not quite take the load and died.

Sensor hardware: We switched to using RGB-D sensors. We still had the IR-sensors but the main sensor now became the RGB-D camera.

Project work documentation: Only a group status report was required every week. The individual reports did not quite provide enough information to be useful. They therefore harmed more (took time to write) than they helped.

We also required a project plan to be submitted at the start of the project.

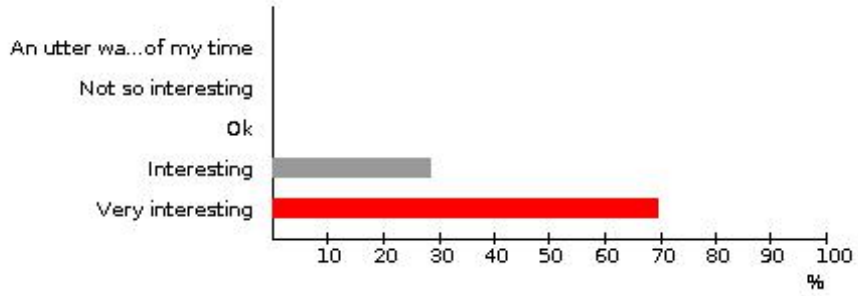
Planned changes:

- Improve the custom made board to take the load without dying
- Buy one more NUC per group to make development simpler.
- Extend the ROS lab so that it really teaches the students how to use ROS so that all can contribute better in the group.
- More project meetings one on one with the groups to give feedback.
- Find carpet or similar to put on the floor so that we can have exactly the same floor surface in the lab as in the contest area.

Survey results

Survey:	Course evaluation
Status:	open
Date:	2014-08-31 00:37:12
Group:	Participants (DD2425 robot ht13)
Answered by:	24(45) (53%)

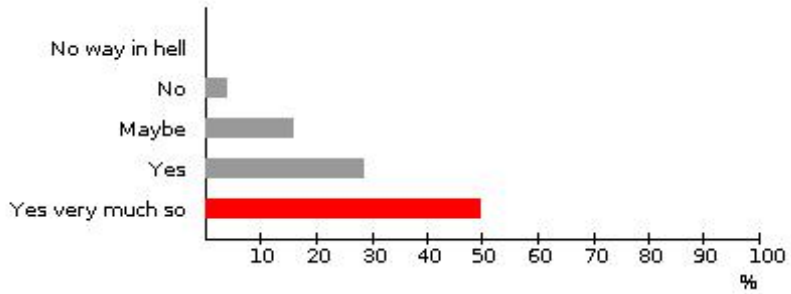
Did you find the course interesting and meaningful?



number	distribution	answer choice
0	0%	An utter waste of my time
0	0%	Not so interesting
0	0%	Ok
7	29,2%	Interesting
17	70,8%	Very interesting

24 has answered of 45 (53%)
Maximum number of choices: 1

Would you recommend this course to a fellow student?

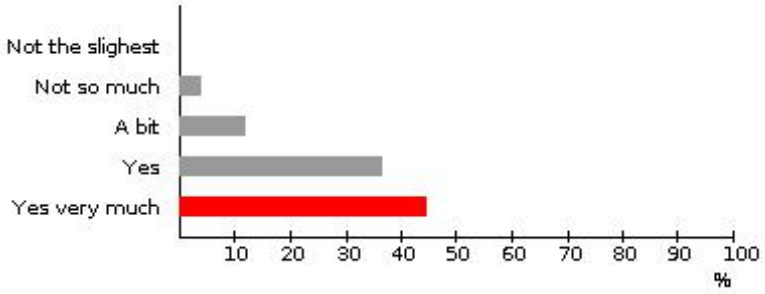


number	distribution	answer choice
0	0%	No way in hell
1	4,2%	No
4	16,7%	Maybe
7	29,2%	Yes
12	50%	Yes very much so

24 has answered of 45 (53%)

Maximum number of choices: 1

Did this course make you more interested in robotics and robotics research?



number	distribution	answer choice
0	0%	Not the slighest
1	4,2%	Not so much
3	12,5%	A bit
9	37,5%	Yes
11	45,8%	Yes very much

24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-I was already really interesested by robotic stuff, so this course didn't improve my interest, but kept it !
-I think I'll try to build a better second version as soon as I have the space and the money for it :)
-You did not really describe what does research currently.
-After implementing a very heuristic approach to the SLAM problem, my interest in learning and implementing a state-of-the-art system grew a lot.
-Was already interested in robotics, became more interested as my knowledge increased

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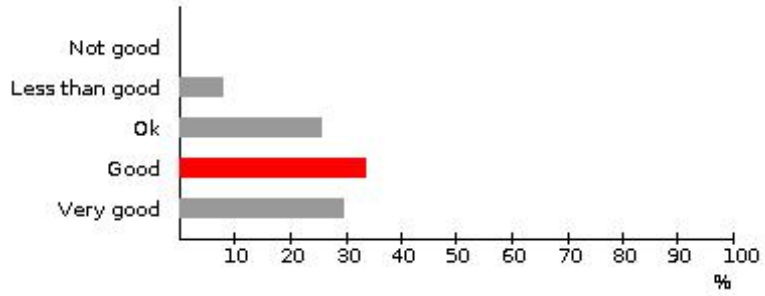
What do you think about Patric's lectures?



number	distribution	answer choice
0	0%	Not good
2	8,7%	Less than good
6	26,1%	Ok
8	34,8%	Good
7	30,4%	Very good

23 has answered of 45 (51%)
Maximum number of choices: 1

Comment:

-I was really excited about the concept of chatting in group during the lecture about the different topic, but it only happens three / four times (not sure of that). The lectures were good, even if there were not really usefull for the project.
-The lectures had a clear structure that resembled the course book, had a nice informal atmosphere that allowed for questions and discussion and were generally quite interesting.
-However, they require a lot of previous knowledge (that can be obtained by the book in the bibliography).
-The idea of half of the lecture theory and the rest group discussion and reflection is a nice one.
-They are good, but they lack the written answers to the questions in the end of each of them.
-They would be rated as 'Good' if the course was solely a project course. Having a whole period of lectures, I would expect, if not a deeper look into the subjects, at least good pointers on what and why to study certain subjects, instead of just casually going over the topics.
-All the discussions around questions at the end of each lecture is an excellent idea.
-Did not attend the majority of the lectures, so no real opinion about this question

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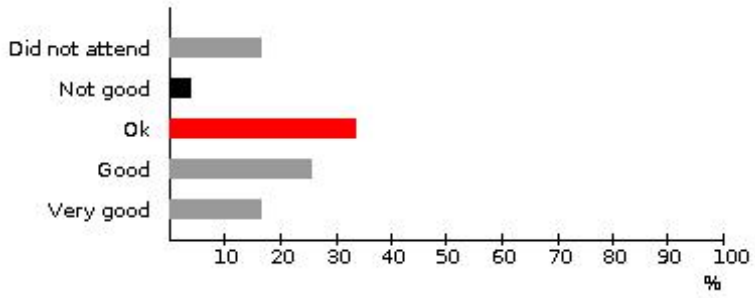
What do you think about Joakim's lecture on project management?



number	distribution	answer choice
4	17,4%	Did not attend
1	4,3%	Not good
8	34,8%	Ok
6	26,1%	Good
4	17,4%	Very good

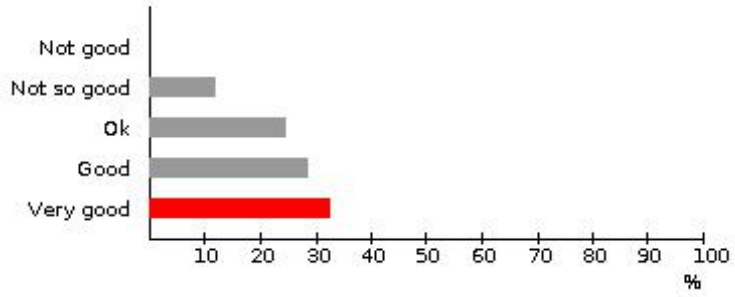
23 has answered of 45 (51%)
Maximum number of choices: 1

Comment:

-I already had project management lectures in my home university. So it only refresh my mind.
-I had the full PM course instead. While Joakim makes some good points, that information is also fairly abstract. Since the robotics teams only have one shot at organizing and cannot evolve much, some more concrete best practices could be useful - especially concerning configuration management (as in: how to use git without shooting yourself in the foot).
-It's good that you emphasize the importance of project management but I didn't find this particular lecture very interesting and also not at all helpful for this particular project.

I think that Patric himself could have held a lecture that would have applied better to this course.
-Course is good, but that didn't really help me and the group: a plan is useless if the schedule of each member is not fixed. That's why you should let people choose their group.
-Well paced and structured. Very interesting.
-It was interesting but to be honest it did not help anything in the project
-He did a great job!

How did you like the lectures in general?



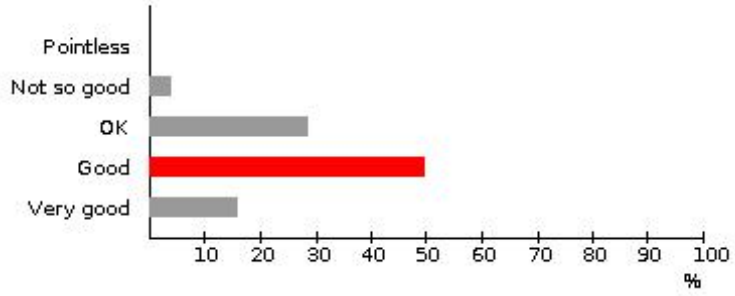
number	distribution	answer choice
0	0%	Not good
3	12,5%	Not so good
6	25%	Ok
7	29,2%	Good
8	33,3%	Very good

24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-The could be given in a better moment. Not everything at the beginning. We could have started with the lab since september with several things and then on the run learn more about some details, such as mapping
-It was a bit too much like a catalog of algorithms but there was no deep development. More details and exercise on specific part could have been intresting
-Except the Ethics one. I did enjoy the topic but she turned out not to be the best lecturer unfortunately.
-They are fine.
-See comment on Patric's lectures
-did not attend the lectures

How did you find the group discussions at the end of the lectures?



number	distribution	answer choice
0	0%	Pointless
1	4,2%	Not so good
7	29,2%	OK
12	50%	Good
4	16,7%	Very good

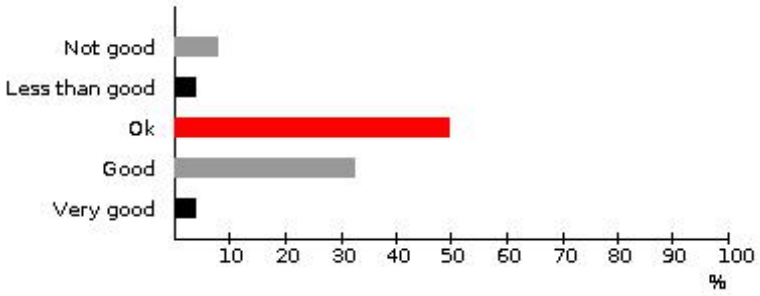
24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-It was hard to react to such global questions. Most of the time we agreed instantly on something and didn't mention anything else.
-A great idea to wake people up and get them thinking. This way, even students who missed or misunderstood something

have a chance to catch up.
Maybe break the group discussion questions into two blocks and discuss the first answers in between. When confronted with a large number of questions and an unclear amount of time, groups tend to rush over the questions and become too superficial.
-The time could be spent in a more meaningful way, however it was definetely good to create "bonds" between the group.
-It's great to discuss with the member of your group.
-Good to get acquainted with the work group, but too short in time.
-did not attend the lectures
-Sometimes the lectures progressed a bit fast and as the questions at the end often were quite detailed you couldn't answer them immediately without having a closer look at the theory
-Often not much time was left for discussion.

What do you think about the connection between the lectures and the project? Could you used what you learned in the lectures in the project?



number	distribution	answer choice
2	8,3%	Not good
1	4,2%	Less than good
12	50%	Ok
8	33,3%	Good
1	4,2%	Very good

24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-I'm sorry to tell that the things we did in the lectures weren't really usefull for the project. We didn't discover so much during the lecture.
-I could used them but I thing the timing was not right
-Some ideas, especially concerning mapping, were certainly inspiring. On the other hand, many concepts seemed to be too advanced in the sense that they were either not applicable to our task or at least too difficult to implement from scratch in the available time. I would have loved to play more with the algorithms presented, but would have needed some existing code to start with.
-I can't say that it helped me that much, I see them more as a complement in the course.
-Actually, the algorithms seen during the lectures were a bit too long to implement and test in the project. Maybe more details in the algorithms during the course could be useful to develop further the project
-You cannot map everything from the theory to the practice, but still I think that the lectures helped us and guided us in the project.
-In fact, the course can give inspiration about a solution, but after that, it doesn't help that much.
-With the time span we have for the project, its difficult to implement robust solutions to the problem at hands. The place where useful connections can be made is mostly in sensor usage, in my opinion.
-did not attend the lectures, would have preferred to have lectures with peak knowledge or details and not just summaries of parts of the area. Then I probably would have attended them, but there was no real point sitting for 2 hours listening to something that I could read in half an hour
-Lectures were good overview, but I did not look at the lecture slides when I was going to solve something or do something in the project. I guess it would defeat the purpose of the course if the answer was in the slides. But it is a good initialization of things just to familerize yourself with some of important concepts.
-The lectures content covered most of the things one has to think about during the project, some things were of course too complex to be implemented

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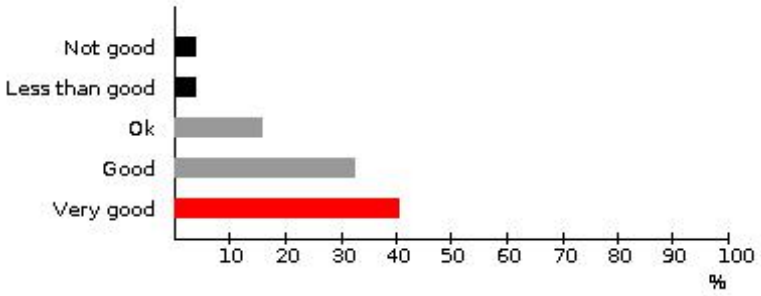
What do you think of the ROS lab? Did it help you get started? Did it help peope in teh group to know ROS?



number	distribution	answer choice
1	4,2%	Not good
1	4,2%	Less than good
4	16,7%	Ok
8	33,3%	Good
10	41,7%	Very good

24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-It was good to actually work on ROS by ourselves before the real beginning of the project. We all managed to understand different things with ROS that we can use.
-Extremely necessary
-This made many things clearer and pushed everyone to dive into ROS before the project starts.
-Perfect for integration and teamwork as far as you get use to it and everybody use it wisely
-This was extremely helpful!
-Yes, I think that this is a great way to ensure that all the members in the group are able to develop code and useful work for the project.
-This is a must-keep for the next year's student.
-You should have made more examples. Just seeing the turtlesim and starting the project after is a bit hard...
-It's a vital lab. Everything in the project ran over ROS, so its fundamental that every group member gets to know it well.
-ROS was a great way to structure the group work. It was a great tool for debugging signals and functions.
-Didn't get what was happening but I still did something. Maybe more specific instructions would help.
-Since the people that would have needed the ROS lab to get started did not do it, it did not help at all. Otherwise I think the lab was good.
-It helped understanding robot manipulators but it was also really hard to follow the math in such a short time
-Too much of a complicated topc in short amount of time.

General feedback about the lecture/theory part of the course

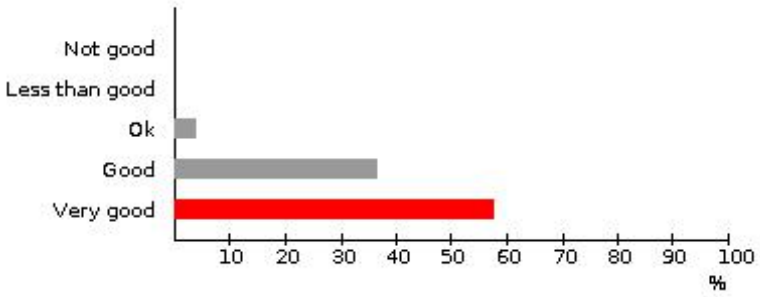
13 has answered of 45 (28%)

Comment:

-I didn't like so much the lecture since, in my opinion, they weren't so much usefull. Indeed, we spend most of time discussing about things we already know or things that we could not use for the project. (like the exercice session about the robot arm, what was the point of doing that ?)
-We could learn the most important parts of the theory with short laboratory sessions. It could make mapping and localization something extremely easy to begin. Therefore when the time came for the project we could have used something even deeper.
-During the lectures we do not really learn thing, or it was not useful because to complicate for the project or not developed enough.
-Good in general,
More development in simple algorithms such as we can use them for the project
-They were good, however not super educational (but it is normal, these lectures are just supposed to be an overview).
-Good.
-Good, even if it is not that usefull after for the project.
-Quite ok. I think I learn more having discussions instead of just hearing you speak. No offenses, it think it was a great job.
-It felt like a small complement to the project part.
-The lectures are only introductions to various functions needed to get full points in the course. You get an overall introduction to robotics.

-Since nothing was really explained in detail but the theory mostly tried to cover as many areas as possible as time efficiently as possible the theoretical part did not help very much with the project.
-I think they are good general summary.
-Useful information for the project

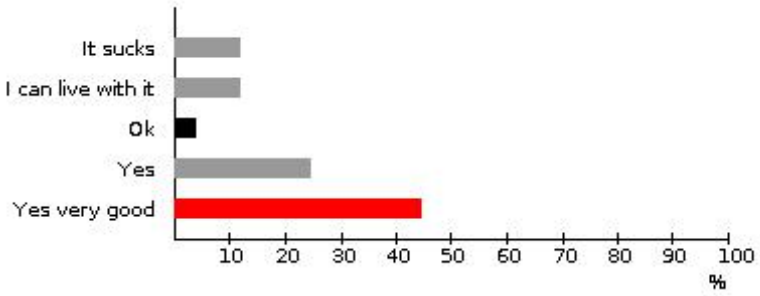
How did you like the project?



number	distribution	answer choice
0	0%	Not good
0	0%	Less than good
1	4,2%	Ok
9	37,5%	Good
14	58,3%	Very good

24 has answered of 45 (53%)
Maximum number of choices: 1

You were divided into groups partly based on your skills and NOT knowing one another before. Do you think that this is a good way to do it?



number	distribution	answer choice
3	12,5%	It sucks
3	12,5%	I can live with it
1	4,2%	Ok
6	25%	Yes
11	45,8%	Yes very good

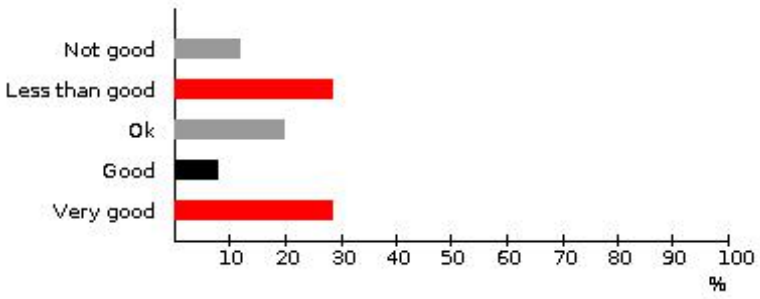
24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-It was good to put people together based on the skills. But in our group they were maybe too much difference in the investment. And since we didn't know each other much, it was hard to be honest about our thought regarding the work made by the others.
-It is good. However the selection of the people for the project was not ok. It should not be permitted to be in the project

for bachelor students, when there were some master students that wanted to take the course.
-It worked very well for my group.
-I tried to defeat the system and fail the test as much as possible without being obvious about it. Something for you to consider for next year.
-It was very goood. I was actually very scared about it, but our group managed to work well together.
However there were groups who did not had the same luck, I feel bad for them, and wonder if I would have liked this division of groups if I had been placed in a bad group :/
-The idea is a good one, the only downside is that you might end up with people you dont work very well with, but I guess that's life.
-Skills don't matter that much. Algorithms are so hard sometimes that even guys who made image analysis can't deal with it. What matters the most in a project is to have very motivated people working on it with the same schedule. I was motivated to work with people I had already worked with (they were 3, we would have been 4), because I know we would have been very efficient and we had the same schedule. That's why I was a bit disapointed not being able to choose my group. I really think you should let first people choose their partners and after use your test on skills. Working with a wanted team matters the most. :{
-The problem with not knowing the other group members is that you may end up in a group that doesn't work very well together, which hurts everyone in the group. The upside is that you get to meet new people with different outlooks.
-Getting out of the comfort zone is something that really gives a 'real life' feeling to the project. It is stressful at first, but getting through it is a huge confidence booster.
-Got a nice group, otherwise it would be more difficult.
-Maybe just let everyone know what are the skills you are expecting. As Joakim said let us know your expectations.
-Sure I made some new friends which was nice, but it ruined the project and the whole course for me since it is a course I had been looking forward to. The division should either be divided up by the students or by ambitional level. Otherwise people that don't bother learning stuff get carried by their group and a undeserved grade
-Makes the project more realistic, in a company you usually don't get to choose the people you work with as well so this is how it should be
-Best approach! Only like this, the members with different skills and specializations are distributed equally.

How did your group work together?



number	distribution	answer choice
3	12,5%	Not good
7	29,2%	Less than good
5	20,8%	Ok
2	8,3%	Good
7	29,2%	Very good

24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-We had almost three groups in our group. (motion/mapping VS vision VS mapping)
-As a group was not as expected, there were some people that were not focused in the course.
-Something didn't work there. We've all speculated a lot about it in the group and self reflections, but I'm still not quite able to pinpoint it.
-We never really got a good work flow going.
-We had different aims and ambitions, but overall, since none of us was simply lazy, we managed to have everything going well.
-The group was mainly individualist and they were craving for credit hence they preferred not to cooperate which was a shame.
-We did not have the same schedule... So it was hard.
-Unfortunately the expectations each group member had in respect to the workload/task at hands were very different,

meaning that the division of the work load wasn't very balanced.
-The group work was hopeless, even so that I halfway through the course talked to the student counselor about dropping the course since we had no chance of reaching the milestones. Resulting in that I spent an average of around 10 hours per weekend on the course other than all of the time I spent during the weeks in an attempt to save our project. Which in it's turn worked, but the group as a whole got all of the credit for it.
-I was very lucky and everyone dedicated to the project and contributed as much as possible

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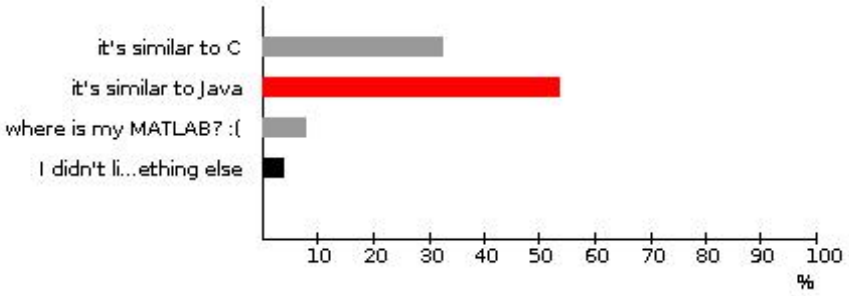
How hard was it to get used to C++?



number	distribution	answer choice
8	33,3%	it's similar to C
13	54,2%	it's similar to Java
2	8,3%	where is my MATLAB? :(
1	4,2%	I didn't like it -- I prefer something else

24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-Easy after the first lab assignment
-I was already used to C++ before. What I still can't seem to get used to is that even at the end of a master's program, there are still so many people who don't know it. At least half the team needed to pipe their code through me as some sort of fuzzy pre-compiler before it was presentable to g++.
Given that the course is so popular and seats are limited, some stricter admission requirements on programming skills might be justified.
-It's very similar to both C and java, this should be a multiple choice question :-)
-I learned C two centuries ago, so when I came back to it, I had already forgotten most of it. It was hard to work in C++, but I guess that that is what is used in the real world so I had to do it.

I do miss my MATLAB however, very fast prototyping, lots of functions already integrated, and very simple debugging.
-C++ is not that a problem. And a lot of robotic platforms use it so I think I had to cope with it. But enabling using Matlab would be interesting.
-I already knew C and C++ prior to the course, so there was no learning curve at all.
-Compiling is a bit hard.
-Computer Science :)
-semi columns everywhere why god why? ;)

5 option..Nahh you get used to it :) and it is fun
-As a computer scientist it was not too hard to get used to it

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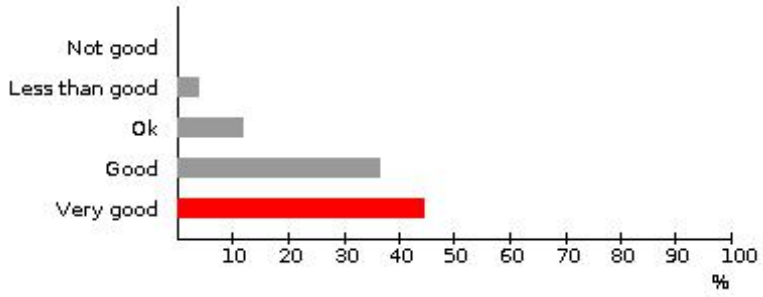
What did you think about ROS?



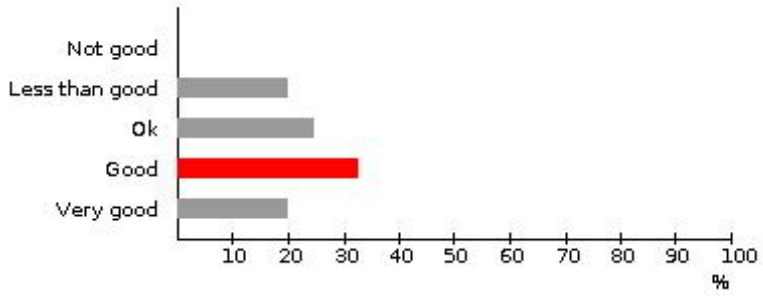
number	distribution	answer choice
0	0%	Not good
1	4,2%	Less than good
3	12,5%	Ok
9	37,5%	Good
11	45,8%	Very good

24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-We lost a fair amoung of time with ROS bug that we didn't understand. And it was really hard to find helpfull stuff on the ROS wiki. Most of the time we had something not working for an ununderstandable reason and we fix it with die and retry method, not knowing what actually was the right fix.
-Easy after the first lab assignment
-First it had me cringe at the messaging overhead - but since we managed to keep the RGBD data in one node and only pass rather small messages around, ROS was very useful for modularization. The existing visualization tools were also handy.
ROS could be even more useful to this course if a more recent version were used (fuerte couldn't be built from source any more since some online build scripts had vanished) and if students got some more hints on existing packages (which packages exist that are relevant to our kind of robot? how much canned functionality is allowed?).
-I really enjoyed working with ROS, it was one of the best things with the entire course.
-Great tool for this project!
-once you get the hang of it it's awesome.
-Sometimes, you don't know why the compiling is not successful and can't find help on forums. That's very frustrating.
-Not having to program the communication protocol between different project nodes is what makes it possible to do the project in just one period and with other courses.
-Awesome once you understand the whole concept behind it. Let's you work in modules.
-It's a good system, helped a lot in the project
-Made the start of the project a lot easier, provides a good interface to access the sensor data and stuff
-Very useful for better team work because work can also be split up logically in ROS, but still works together due to well-defined interfaces.

What do you think about the idea of using a VirtualMachine for some of the development and testing?



number	distribution	answer choice
0	0%	Not good
5	20,8%	Less than good

6	25%	Ok
8	33,3%	Good
5	20,8%	Very good

24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-It was usefull but I didn't use it at all once the project was started.
-This avoids a lot of problems with incompatibilities with student's systems and makes it easier for students who have never used a GNU/Linux system before. If the RGB-D sensor is to be used in the following years, however, it would be nice to be able to run ROS directly on the host machine, too. => Use newer version of ROS.
-Far too slow for many computers !
Using a remote desktop on dedicated computer could be better or reserving a room to do the work as a lab could also work
-I mean there is nothing wrong with the idea but it was hard in practice because for a lot of subsystems you rely on sensor feedback.
-I guess people use VirtualMachine just because they are afraid of installing a full new OS. VirtualMachines are slow and usually have more problems (like interfacing with the PrimeSense).
-Very nice feature, also a must-keep.
-It is better than depending on having to be on the lab to do the testing, but having Ubuntu on a separate partition is definitively the way to go for me.
-Did not use the VM.
-The virtual machine was a great help for very many getting started with and not forcing a new operating system on someone.
-For us it was good in the beginning to get used to ROS but in the end we developed basically everything either on the NUC or we installed ROS on a real Ubuntu because the VM could not deal with the kinect camera

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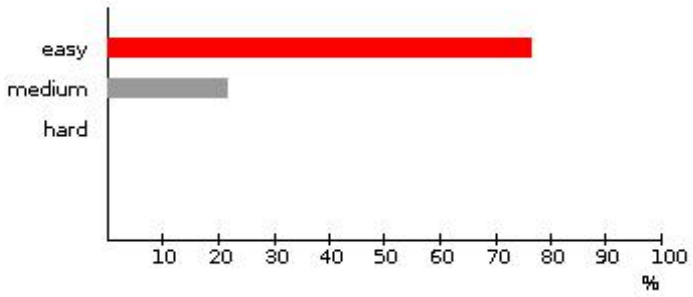
How hard was Milestone 0?



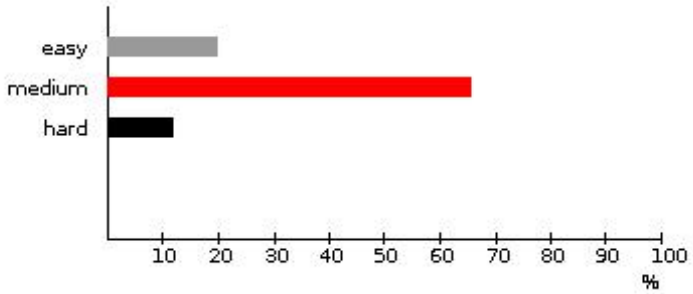
number	distribution	answer choice
17	77,3%	easy
5	22,7%	medium
0	0%	hard

22 has answered of 45 (48%)
Maximum number of choices: 3

Comment:

-The task was slightly unclear at first, but after 1-2 questions on Bilda, it was just fine.
It was, however, not quite in line with the later tasks: Tracking a hand is quite different from detecting floor/walls/objects on the floor, and the motor control following the camera data continuously was a very different approach from the motion planning that was required later. We thus ended up writing quite some code that was only relevant for M0.
An alternative for M0 could be implementing basic maze movements (turn, go straight, follow wall, either for a certain distance or stopping at wall in front) and using them to move around a few simple corners, possibly hard-coded.
-It was ok. However when we were told we were supposed to follow a hand I got really scared since I thought we were supposed to only follow a hand that was caught by the camera!
-But you should put it 1 or 2 weeks sooner in order to have more time for milestone 3.
-I believe my group tried too complicated solutions for most of the milestones, which hurt us in the long run.
-Very important milestone to get the basic structure of the project going on.
-All of the milestones were quite easy

How hard was Milestone 1?



number	distribution	answer choice
5	20,8%	easy
16	66,7%	medium
3	12,5%	hard

24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-Concerning the maze navigation, M1 was fair. We should have actually put more effort into this, but suddenly getting the whole object detection running seemed like a huge and thus more critical task.
-We gave 150% for this milestone, so that we could have an as robust as possible motion controller for the robot that we could trust for the remaining milestones.
-All of the milestones were quite easy
-We had enough time and we were quite happy with what we delivered there, we didn't just do wall following but were already able to drive through the maze, but maybe that was because we focused less on the vision

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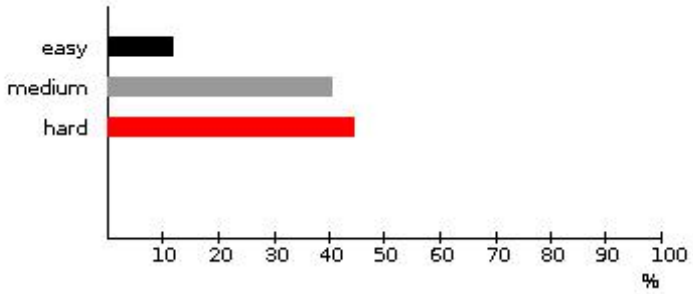
How hard was Milestone 2?



number	distribution	answer choice
3	12,5%	easy
10	41,7%	medium
11	45,8%	hard

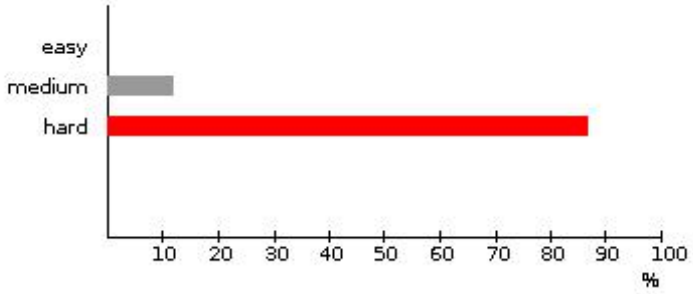
24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-This is where it ends when the chosen mapping and navigation solution doesn't work.
-With all the effort put into milestone 1, this milestone was mainly about tuning the controllers and adding a data structure to support the map.
-All of the milestones were quite easy, the time plan for milestone 2 and 3 probably should have been moved so that they were placed earlier
-Building a map was a quite challenging task for us, we finished our video hours before the deadline and we were only kind

of happy with it

How hard was Milestone 3?



number	distribution	answer choice
0	0%	easy
3	12,5%	medium
21	87,5%	hard

24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-In general I think that the deadlines for the two first milestones could be earlier as to make room for more time for the later milestones.
-hard if we really want to do it correctly, and medium by cheating a little on the video.
-Not enough time.
-All the integration problems came into play here, and the small time difference between milestone 2 and 3 really makes it difficult to implement and test everything.
-All of the milestones were quite easy, the time plan for milestone 2 and 3 probably should have been moved so that they were placed earlier
-the time between M2 and M3 was really short, a lot of work had to be put in this time to make the milestone

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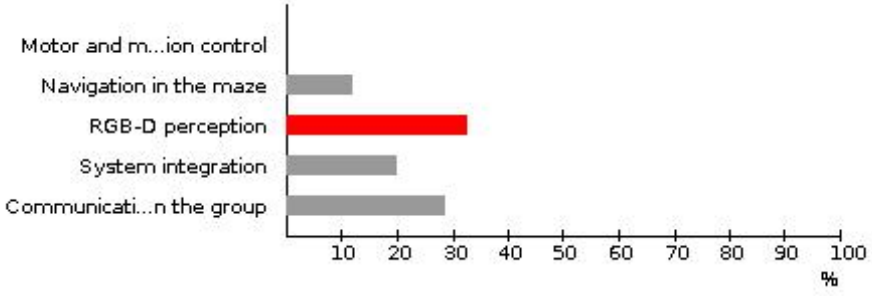
Which of the following do you think was the hardest part of the project. Write other below if you cannot find your choice



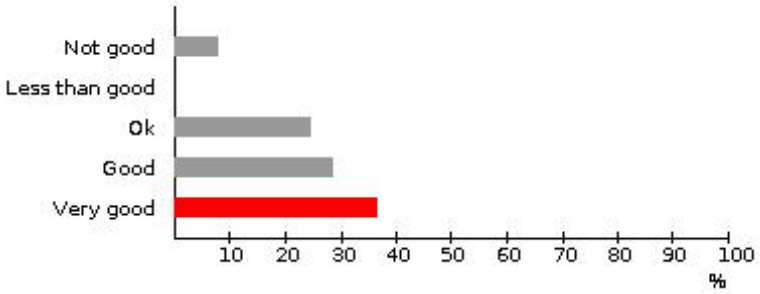
number	distribution	answer choice
0	0%	Motor and motion control
3	12,5%	Navigation in the maze
8	33,3%	RGB-D perception
5	20,8%	System integration
7	29,2%	Communication within the group

24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-Communication was hard for us which made all the other parts suffer.
-Navigation in the maze, is really hard, since mapping and location are the biggest problems we are facing in this project.
-Because it's very hard to transform rgbd data in c++ data.
-I didn't work on the image processing part, but I am aware that, if not the hardest, at least is the fundamental part of the system. We had good motion control, a very decent mapping system and high level controller to explore the maze, but it just takes on undetected object to destroy everything.
-It's not easy communicating with people that does not want to communicate
-Never try big bang integration!
-Vision with a 3D camera was a quite new topic to everybody. Some advised starting points would have been good. Additionally, we should have warned not to spend too much time in vision, but also in more elementary robot functions.

How did you like the contest event at the end of the project?



number	distribution	answer choice
2	8,3%	Not good
0	0%	Less than good
6	25%	Ok
7	29,2%	Good
9	37,5%	Very good

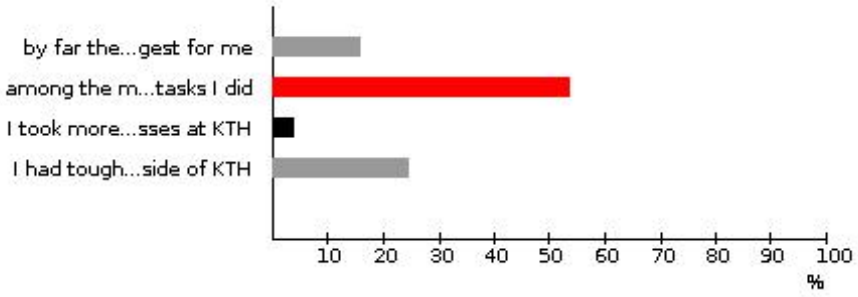
24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-Even though we couldn't get our robot to work, it was fun and interesting to see the other team's solutions.
-Too many robots were not working... The quality of the competition was not reflecting the work that we had done during the course... a bit disappointing

But everything was gathered to spend a good time ! and the pizzas were really good ! thank you ^^
-I feel that most of the groups performed worst than what they were capable of (maybe because we were only developing our project for the Test Maze in the lab).
-The contest idea is a good one but with all the poor robot is was a very uninteresting one.
-In fact, my robot failed for unknown reasons so I could not really like it. The field should be smaller, it took too long to go through it.
-The idea is great, and I found it to be well implemented. The main problem with this year's implementation, with respect to previous years, is that now that the objects are physical, failing to detect one results in going over it, ruining the odometry. This means that even if every part of the system is perfect, aside from vision, we cannot use the competition to show it of, and that is a shame.
-System integration failure...
-Probably should have changed some of the scoring, so that a group that actually performs the instructed task achieves a high score through this. Should also decrease the size of the maze so that it is actually a possibility to complete the task if a robot actually has the required functionality
-Its fun to see what other people did
-Free pizza and nice atmosphere :)

How big of a software project was programming the robot for you?



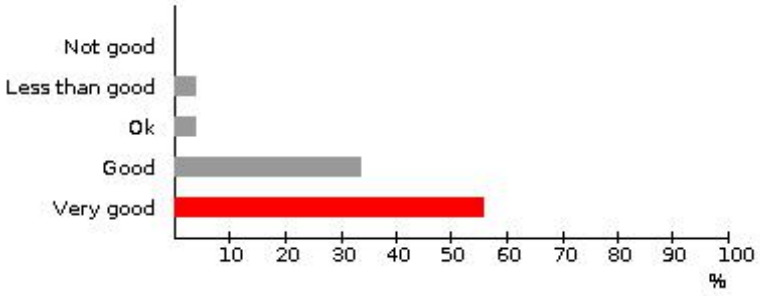
number	distribution	answer choice
4	16,7%	by far the biggest for me
13	54,2%	among the more complicated programming tasks I did
1	4,2%	I took more demanding project classes at KTH
6	25%	I had tougher projects outside of KTH

24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-In terms of lines of code, the projects in my early programming courses were bigger. They were, however, done at most in groups of 2-3, and were still solvable if one of them lacked the motivation or programming skills.
-I've never done a SW project this big before and I've never learned so much in one project either :-)
-But with a good team, the complexity doesn't matter.
-Implementing a fully integrated system is a great challenge and lots of fun.
-I couldn't make it work, but it was still very interesting.
-It was a bit difficult that the requirements were so vaguely specified, other than that all software difficulties came from the group's communication
-Its always challenging to work with code from different people, but four is still ok and even though quite a bit of code is produced in the end, organizing it could be worse
-Not only hard, but extremely time consuming.

How would you rate Francisco's help during the course?



number	distribution	answer choice
0	0%	Not good
1	4,3%	Less than good
1	4,3%	Ok
8	34,8%	Good
13	56,5%	Very good

23 has answered of 45 (51%)
Maximum number of choices: 1

Comment:

-Francisco was really available and always ready to provide help. That was really cool.

-That guy really knows what he is doing
-Quick, helpful and polite responses, always :-)
-Always helpfull and available at almost any time. He did a great job!
-A+ to that guy
-But in fact, he can't correct everyone's code... He did all that he could do.
-Always available to help, concerned and insightful. Francisco always offered great support upon request.
-He was replying really fast.
-Only asked like one question, which was answered :)
-He helped where he could

Comments in general about the robot hardware (Arduino, NUC, motors, sensors, ...) and how it could be improved

15 has answered of 45 (33%)

Comment:

-The IR sensors are such a pain!
-It should be a little bit more robust, because transistors burning in the middle of the project is not something fun. Sensors and motors were good enough. The caster wheel got dirty very often.
-The concept of how the power is distributed could be developed further. The ultimate would be two battery connectors and one DC jack, and everything staying powered as long as at least one of them (but up to 3) is connected. That should work even when the robot needs power for funny movements and heavy number-crunching at the same time ;)
The cables became a big mess. Suggestions are:
- Integrate components (e.g. a USB hub chip and the IMU on the custom power board, short connection to the Arduino from there)
- Use shorter cables, angled connectors and/or Micro-USB connectors
- Provide USB cables and connectors for custom assemblies
- Replacing the camera cables with shorter ones could be tricky wrt EMC, but voiding warranties is fun!
- "pin header on wire" connectors are notoriously unreliable, and it was the same this time with the sharps and encoders. The connectors that are used on the sharps themselves could be a good replacement (JST PH series, e.g. at Digikey).
- An add-on for the lab introduction slides: The sharp casings are conductive, forming a ground loop with the robot chassis. Mounting them with nylon screws and a layer of electrical tape on their backside improves measurements.
-The custom boards must become more robust, allowing hotswap is a must have in my opinion. If possible it would be a good improvement to use the digital version of the IR sensors instead of the analog, we had problems with signal interference on the arduino board which could be easily avoided that way.
-OK
-A really good set to build fast a that kind of robot. Really easy to implement as well. The motor shield is really convenient.

Be careful to the power supply with the sandwich card... We almost killed our robot with it ^^. The transistor on the card witch allows the hot-plug is not well chosen.

As well, the arduino code given at the begging has to be changed... It is a bit messy and not really working properly. It could be part of a starting project for milestone 0.
-- Change the custom boards :)
- Explain or change the Arduino code
-No comments.
-Nice wiki
-The only complaint I can think of is that the custom board used in the Arduino sandwich wasn't apparently designed to handle the NUC's current demands, resulting in several burnt transistors. Besides that, the hardware we had available was of excellent quality.
-Some small major fault in component choice in the regulator for the motor shield. Otherwise a great and simple way to quickly get to speed with programming the robot. The encoder to odometry was faulty in the arduino program.
-Each group should have the same components. My group designed the robot after what we were given and realized later on that there were extra components that could be gotten if we would have asked for it. All should work on the same terms, especially since the focus (non graded) is on the competition
-We did not have any problems with the hardware in our team
-I think we had everything we needed, we missed hot swapping the battery in the second half of the project
-Improve custom board to handle higher currents.

Comments in general about the project

13 has answered of 45 (28%)

Comment:

-Excellent job. But too much writing at the end.
-While new technical features have been added to the robots every year until now, I think it is now time to cut down on the complexity a bit. The difficult question is: What are students supposed to figure out on their own, what can reasonably be provided as SW or HW modules and what might be completely unnecessary?

-The best project I've done so far at KTH!
-great experience, but it would be better to have motivated teammates.
-Great experience ! really interesting and motivating ! I have learnt a lot and specially in the teamwork.
-Nice project
-Making at the same time, similar object detection and mapping is a bit too hard. I think you should choose one of them in priority. For instance:

-a trial where you have to avoid obstacles and move in small corridors, which would focus on detection and motion.

-a trial where you have to map the whole maze where the only object detection is to recognize colored figures on the wall, which would focus on mapping.

-or a rush where you have to move along a "not straight and curved" corridor, and where there are break points, where you have to recognize a 3d object. Not making recognition results in penalty time. That would focus on object detection and motion (because going too fast may make the robot crash in a curved wall)

Aren't these trials cool? I find them more interesting, and less hard than the one we had this year. Excepted the first one maybe.
-It's challenging, demanding and lots of fun. Implementing a robotics system from the very beginning in a controlled college environment is a luxury I am lucky to have had.
-Great project!
-Make the milestones public and into the battlefield.
Make the time between the milestones the same.
-Good project, task was tad bit too much but you learn a lot.
-The whole project would have been fun and interesting if one would have been placed in a decent group. But since the division into groups was as it was it will instead be remembered as one of the worst experiences during my education.
-One of the most interesting courses I ever took, I learned so much and had lots of fun

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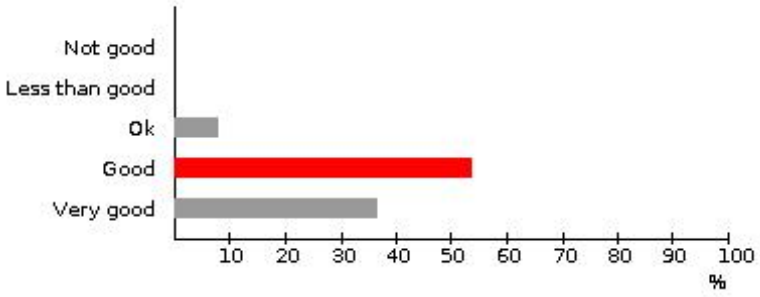
How did you like the debriefing session at the end of the course?



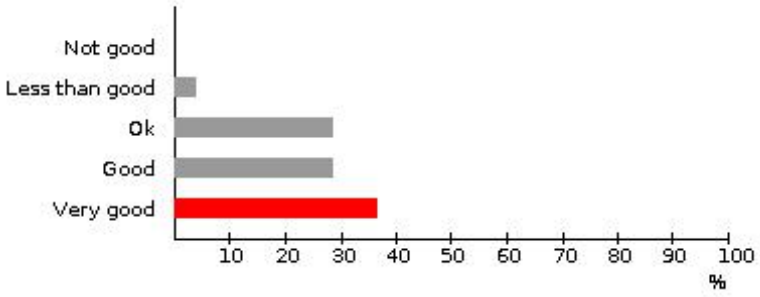
number	distribution	answer choice
0	0%	Not good
0	0%	Less than good
2	8,3%	Ok
13	54,2%	Good
9	37,5%	Very good

24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-Necessary to euphemistically say who did not work and who did.
-In my team, the debriefing session was two of us meeting in a bar, making fun of the others while having a couple of beers.
-Maybe it would be nice to have all the group reports available.
-It was really good to get feedback and be able to get some comments from someone who actually knows about the subject to what could have been done differently.

What do you think about writing the self/group reflections?



number	distribution	answer choice
0	0%	Not good
1	4,2%	Less than good
7	29,2%	Ok
7	29,2%	Good
9	37,5%	Very good

24 has answered of 45 (53%)
Maximum number of choices: 1

Comment:

-Self-reflections were good. The group one is not necessary in my point of view.
-The reflections certainly brought up some interesting insights. However, I felt a bit like writing to /dev/null - maybe have a session where the results are discussed with the group and some feedback is provided?
-Too bad your teammates good not see what you have written, some of my members would have needed to hear it.
-The reflections are an important part of the project, that forces us into thinking about what went good and what did not. But there are maybe too many documents to fulfill at once. One group document and an individual one should be enough.
-Especially the individual feedback was good since it helped with the grading of the project
-Its a good thing, after a project one should always learn from the experiences made

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What would you to say to a potential student about the course in one sentence?

20 has answered of 45 (44%)

Comment:

-Everything is harder than it seems.
-Design in blocks. But integrate the whole system before. Don't trust vision, otherwise you will suffer in the competition.
-A course with group work is always a bit of a gamble, but no matter how it turns out, it will be just as informative and certainly more fun than many of the more theoretical courses.
-It's one of the best courses (if not the best) I've done so far but be ready to spend a significant amount of time on it.
-more a project course than a technical course, I mean that we don't learn so much technical things.
-Really interesting project. Opportunity to apply our knowledge in a work in a team.

But really time-consuming, and a bit disappointing if you don't manage to finish the project as most of the students
-Do it for personal improvement, don't do it for your mental health.
-Don't take the course if you won't have time for it. You will just be a burden for your group.
-Group dynamics is everything - if you can't connect, your robot will be a wreck.
-Don't take it if you don't like programming, and above all if you don't have the group you want.
-This course sucks up a lot of time, but is very rewarding if you can spend that time.
-Awesome and fun course which asks you to work as hard as you can.
-It's the best course you could have at the end of your masters, but be sure you have the time for it.
-It can be an exceptional amount of difficult work, but it is very rewarding if you put in the effort.
-People think in different ways.
-Work hard, but don't be overambitious. Get the basic functionality to work good before moving on. The milestones are not that important.
-Pick one part of the project, make it great and don't bother about the group cause they won't care about you
- The course provides you with tools to learn but it depends a lot on YOU and how much you are willing to give the course (input->amplifier-> output).

-This course requires a lot of time but if you are interested its totally worth it!
-You will learn a lot, but the lab will take much more time than any other course you have participated in university so far.

What would you liked to have seen changed if the contest was run again? Any rule changes? Anything else?

16 has answered of 45 (35%)

Comment:

-The floor was not flat as the one in the lab and then the PID we designed for running became a problem. The I-part got to big when the wheels got stuck and then the car drifted. Something that does not happen in the lab. We should have more chances to run.
-IIRC, it wasn't announced before how many points would be awarded for what. That would have been useful for the teams to consider in their tactics.
Manual intervention is sometimes useful to keep a robot going and make the contest more interesting. -> Define the rules and penalty points for that, suggest some minimal kidnapping detection (e.g. assume robot is moved from a wall crash back to some nearby, more sensible pose)
-more strict definition of the walls limits.
-Maybe simplify rules or helping more people with classes (or helping sessions) on useful algorithms implementation or tools for the project (EKF, SLAM, OCCUPANCY GRID, PID, OPENCV, ...)
-I saw a group whose robot just bumped against the wall and stayed there all the time just playing a song. And that group classified in front of my group which at least wandered well through the maze (however reporting some false object detection which gave us negative points).

I don't think that was fair.
-no it was alright.
-I described other kinds of funnier contests you could run a few lines above.
-A robot that didn't even manage to drive to an object scored more points than a robot that did manage to reach an object, detect it but misclassify it.
-Maybe a more defined way to judge the teams. Checking the rosbags seems to have a lot of pressure on the judges and it takes a lot of time.
Pizza was great thanks!
-I would love to have a 'maze exploration' segment, where we just showcase the navigation system, without objects in the maze.
-I think it would have been good to have a smaller contest earlier in the course, followed by the final contest at the end. It would force groups to have something functional earlier on.
-Have an offical test date before the competition so that everything should work BEFORE the competition start.
-Obviously following the instructions is what should give you score. For instance actually creating a map and following it should be rewarded more than object recognition since it was the main task.
-No don't think so...okey maybe if you do not identify an object and just roll around in the maze or stumble into wall or an animal and crash...please some minus points for that. Or if you start with everyone getting a 1000 points and then you go down in points...then no one has a minus points just less points :)
-The contest was good, maybe put some objects to trivial places as our robot did not encounter any object
-Joker: touch the robot one time

Things you liked about the course?

16 has answered of 45 (35%)

Comment:

-Gives you the opportunity to put into practice many things you have learned in the past
-The teachers made the lectures very interactive, showed a real interest in the course's development, provided materials quickly and were interested in feedback.
The project's open design space allowed us to explore and learn a lot. Even if the contest did not see as many great solutions as in previous years, what everyone takes home is all these little technical discoveries and successes we had on the way, and the experience of group work and how it might be done better.
-a concrete project.
-The project, the atmosphere (I mean the people not the room's smell ^^), the team spirit
-It was really different, and fully hands-on.
It is nice to see our team building a robot from bare scrapes of metal into a (almost) fully-functional robot.
-Making a robot, even if it was a bit too much.

I want to thank you for this opportunity, really. =)
Thanks for all the teachers' team.
-The hardware-software integration
-It was very different from anything else I've done at KTH. Working with hardware and programming it to solve a task was very fun.
-The freedom to implement whatever we would like to have in the final system.
-Open-endedness. Groups just had a goal and no one was holding our hands to lead us to it like in the majority of classes I've taken.
-The platform, ROS, the group, the materials available.
-You get to check a lot of hard problems that have no trivial solution.

-I liked the course until I actually realised what my group member's ambitions were. I think I would have liked all parts (especially the contest) of the course if I would not have been in the group I was in.
-It was the most fun course i have done at kth. I really liked my team and I think it depends on your communication with in the group and how your group members see you as team member and an individual, all that harmony is important. I was very lucky with my team so they made this course really fun, I mean even more fun. I liked the project it was cool to get to finally hold a screw driver and drill some holes :). Programming was fun, challenging but very giving indeed. Proffessor and TA were cool as well and communicative. Getting feedback was a good touch. There was also a good flow of things, organized.

To summarize:
I guess the process of building something real and implementing your own ideas and working together with a great group is what i liked the most.
-I liked that we were free to do whatever we wanted and that we were provided all the material necessary
-Really nice project. I learned a lot of new robotic topics in practise and how to work successfully in a group.

Things that could be improved about the course

17 has answered of 45 (37%)

Comment:

-Maybe more contact between the team and Patric since we were focusing on our stuff and had not much feedback about our work.
-I can't believe that we cannot have a larger room. It got too warm or too cold (when someone opened the window in front of me). A small coffee machine would improve the performance. The project could start way before and have some lectures in the middle of the project (After milestone one) for mapping and localization.
-more useful lectures, more linked to the project.
the final exam is not so useful.
maybe only keep motivated students for the course, because when a group loose a teammate it becomes difficult.
-The subject is a bit too hard, and the course a bit far from the real needs for the project.
-I think perhaps you should have some sort of tutorial or something about code sharing (using github or similar)

It is probably far more important than the project management lecture we had. I would suggest removing the project management lecture and instead having a github lecture.
-The selection process might be better, that is, some of the students might not have the necessary knowledge to be part of a team in this project. If someone does not know how to program well, apply control theory and does not understand computer vision, then it is really hard for him to do anything usefull for the group work.
-Let people who want choose their group.
-Maybe a bit more talk about group dynamics. A lot of people were very unskilled when it came to how to work in a group and this was very devastating for many of the teams.
-I believe the course should be worth more credits, and it should be clearer what needs to be accomplished for the different grades (i.e. grade E is accomplishing milestone 0 and 1 or so, all milestones is closer to grade A, and so on).
-Have modules already defined so every person in the group can choose which module he wants to be responsible of.
-With a project this big and interesting, having an exam that weights 50% of the final grade doesn't make much sense to me. In my opinion, the course should be the project.
-Start work in the lab as early as possible. I think groups should begin working even while the lectures are running.
-Motorshield. Some more sensor placement information on paper that we can relate to when planning what sensors to use and where to place them.
-Group division:
Even though it would increase the risk of people failing the course the groups should be chosen by ambitional level or be allowed to be chosen by the students themselves.
The grading:
For my group I would at least decrease the grading of the project by 5 for all members. I can't even describe how wrong I think the grading was in the project.
The Groups:
Maybe the project should have a smaller amount of freedom so that the groups did not have to be static for the whole course. I really hope that something is done to change this so that no one ever has to have the experience I had in this course. Even just filling out this evaluation makes me really angry since I'm thinking back at the project.
-Having milestone 3 two weeks before the contest and emphasize and emphasize on how important it is to do things on time (I know it has been done in that course, but good sentence is never enough said :)
-Maybe the lab could start a bit earlier already
-The lab room is too small and air inside was very bad most of the time. Eating inside should be forbidden completely.