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E-Portfolios als Lerninstrument

Abschlussdialog zum Projekt „XP2P“

M.A. Marina Zingraf

29. Juni 2022

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University of Applied Sciences

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E-Portfolio Definition

- Digitale Sammlung
- Bewertung des Lernfortschritts
- Multimediale Nachweise über Anstrengungen & Kompetenzen
- Ersteller des E-Portfolios = Besitzer
- Intrinsische Motivation im Fokus

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Kernelemente des E-Portfolios

- Lernnachweise
- Reflexionen
- Feedback

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Lernnachweise

- Artefakte = Darstellungen von Lernprodukten & -prozessen
- E-Portfolio = digitale Ablage, in der Artefakte strukturiert gesammelt werden
- Persönliche Herangehensweisen
- Fähigkeiten zur systematischen und authentischen Darstellung
- Erste Reflexionsdimension für Studierende

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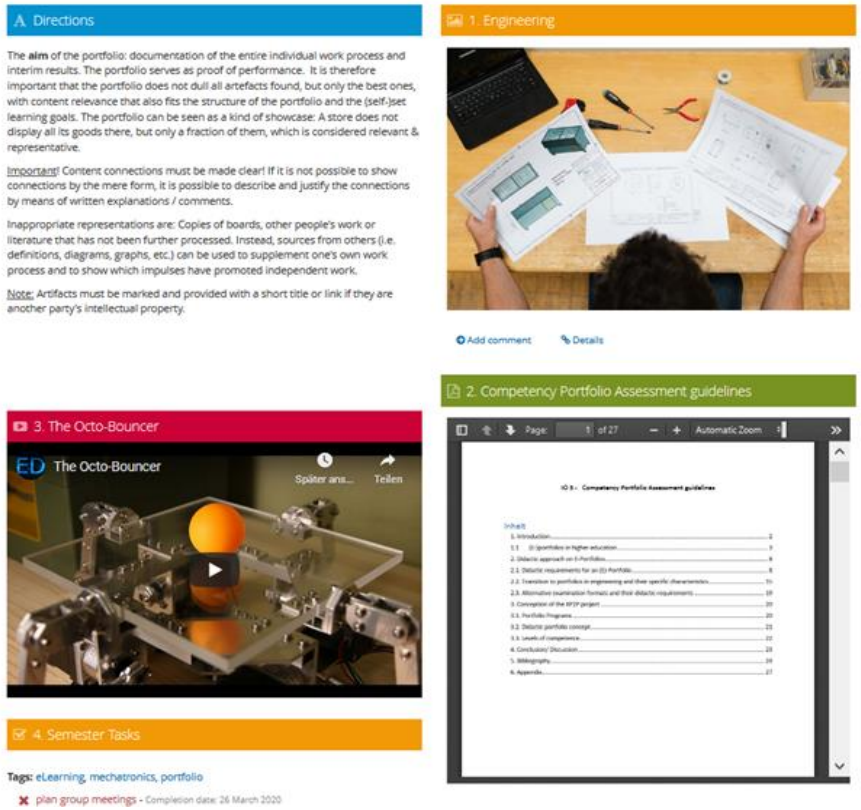
Lernnachweise (Theorie)



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Lernnachweise (Praxis)

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M3 Reflection: Task3- During balancing an additional weight is added and the robot compensates it (stay/return).

Posted by Prabhu Karthik on 24 January 2022, 16:30
Last updated 25 January 2022, 23:16

In this task, after applying some additional weight on top of the robot the vertical axis of symmetry of the centre of gravity (COG) changes. Due to this the robot moves and changes its position.

To make the robot compensate this movement after adding additional weight on top, we made sure it carried the weight and also return to its position and stay there balancing.

Solution:

The **velocity** was **integrated** in order to obtain **position**. The **position** is then fed to the **PID controller**. The **output** of the **PID** is then fed to the sum at negative junction with **Velocity** as error. The summation is then fed to the Mux as shown in figure1. The gains used to achieve stability are **[-3 22 1.0]**'

NOTE: The reason **22** has been used is because the pitch estimate control makes the TWR stable when the value is high with less velocity.

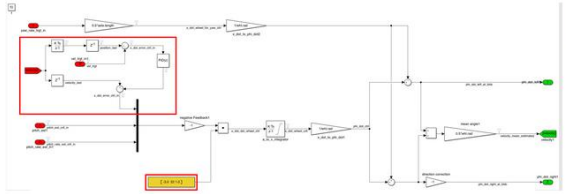
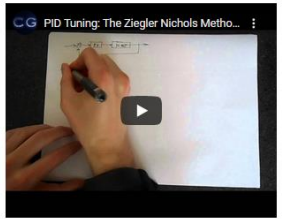


Figure1: My BLDC Control diagram for task3

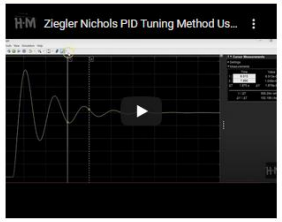
The integrator and the values used in it is as shown in the figure2. The BLDC step limits used are different compared to other tasks and the values are 1 and -1.

The figure3 shows the BLDC step limit of left motor which are same for the right as well.

PID Tuning: Ziegler Nichols Method



Ziegler Nichols PID Tuning Method



+ Add comment Details

Milestone 1 - Reflection

Posted by Maximilian Pfleger on 05 November 2020, 16:35
Last updated 18 November 2020, 15:00
Tags: Control Design, Control System Tuner, Milesone 1, Multibody Simulation, Simscape

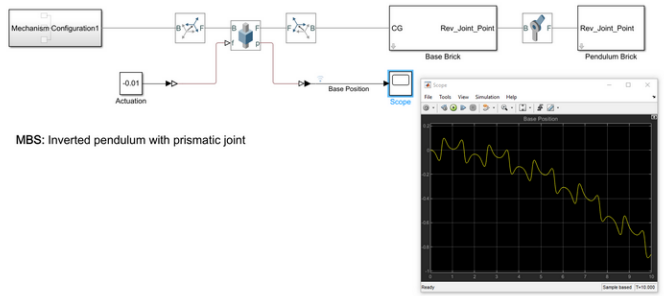
The content of this reflection is about the multibody simulation and control design according to the collateral. It explains the technical details of the model and simulation roughly and gives an overview about what has been worked out so far. To give an idea about the workflow, the aspects that were known before as well as those that had to be learnt are pointed out too.

There was no division of work between group members, as the tasks set are the acquisition of basic skills so far. Each group member worked on their own. Where necessary, members supported each other. The results were then compared and discussed together in team.

Multibody Simulation

The final *Simscape multibody* system (file: *my_inverted_pendulum_prismatic_joint.slx*) according to the instructions is shown in the figure below. The prismatic joint only allows movement in direction of its z-axis. It is configured through "*Rigid transform*"-blocks to allow movement of the base brick in the x-direction of the world coordinate system. Actuation force can be applied, to deflect the joint and move the base brick. The two brick subsystems are configured, that they are connected by their points of interest (centre of gravity, revolution joint). The masks of the two systems can be used to set the edge length, mass of the two bricks as well as the start angle of the pendulum. The plots shown below were generated with the following parameters:

- *m_base = 0,2 kg*
- *l_base = 0,05 m*
- *m_pend = 0,4 kg*
- *l_pend = 0,3 m*
- *phi_init = 5°*



MBS: Inverted pendulum with prismatic joint

Even I did not have any experience in working with *Simscape multibody* before, working with it was straight forward. The robotics lessons in bachelor's programme were quite helpful, as the model setup works like the theory discussed in the course. The *MATLAB* documentation "Get started with Simscape Multibody" [1] also helped by showing how to build a proper model.

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Reflexionen

- Persönlicher Charakter des E-Portfolios
- Nachvollziehbare Verbindung zwischen Artfakten
- Kritische Auseinandersetzung mit dem eignen Lernen/ Lernprozess
- 7 Ebenen der reflexiven Praxis: Beschreiben- Dokumentieren- Analysieren- Interpretieren- Bewerten- Beurteilen- Planen (Bräuer, 2016, S. 28)

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Reflexionen (Theorie)

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Entry Reflection

Posted by Marina Zingraf on 10 September 2020, 13:14
Tags: eLearning, e-portfolio, Reflections

Introduction/ exposé: Presentation, delimitation & justification of the choice of topic. Forecast of the portfolio.

Reflection of the own learning process is a requirement for a successful portfolio. In doing so, it looks back at what has been worked out so far: What has been learnt should be placed in an overall context and viewed critically.

The reflections should be scientifically sound and combine knowledge and competences already acquired in other lectures and seminar units as well as in the Bachelor's programme. Or show which aspects have been neglected in learning so far and are taken up by the respective lecture. Assistance can be provided by means of pre-fabricated forms containing open questions that the students can address.

- Which focus do I choose for my portfolio? Why?
- What knowledge do I already have on the subject?
- How do I want to approach the portfolio strategically?
- At which points do I possibly need assistance?

Important! Use blog entries for reflection. Allow comments. This allows the exchange to take place explicitly at the artifact.

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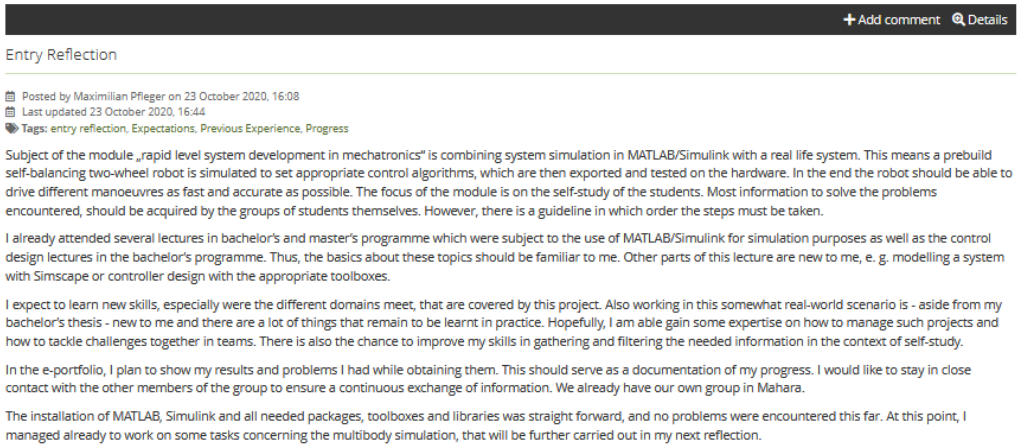
Reflexionen (Praxis)



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Entry Reflection

Posted by Maximilian Pfleger on 23 October 2020, 16:08
Last updated 23 October 2020, 16:44
Tags: entry reflection, Expectations, Previous Experience, Progress

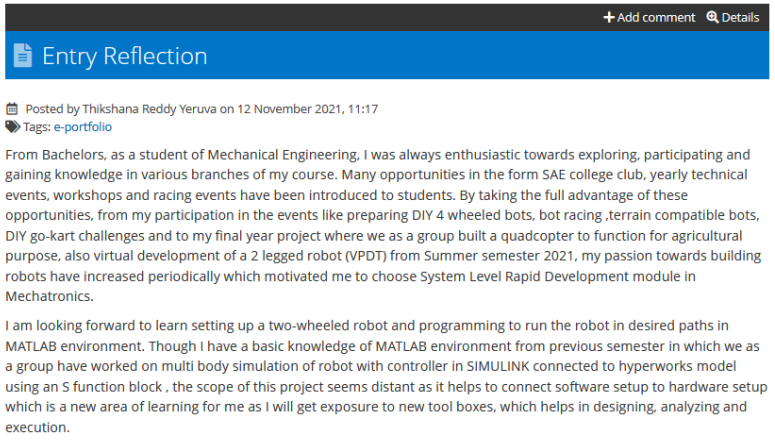
Subject of the module „rapid level system development in mechatronics" is combining system simulation in MATLAB/Simulink with a real life system. This means a prebuild self-balancing two-wheel robot is simulated to set appropriate control algorithms, which are then exported and tested on the hardware. In the end the robot should be able to drive different manoeuvres as fast and accurate as possible. The focus of the module is on the self-study of the students. Most information to solve the problems encountered, should be acquired by the groups of students themselves. However, there is a guideline in which order the steps must be taken.

I already attended several lectures in bachelor's and master's programme which were subject to the use of MATLAB/Simulink for simulation purposes as well as the control design lectures in the bachelor's programme. Thus, the basics about these topics should be familiar to me. Other parts of this lecture are new to me, e. g. modelling a system with Simscape or controller design with the appropriate toolboxes.

I expect to learn new skills, especially were the different domains meet, that are covered by this project. Also working in this somewhat real-world scenario is - aside from my bachelor's thesis - new to me and there are a lot of things that remain to be learnt in practice. Hopefully, I am able gain some expertise on how to manage such projects and how to tackle challenges together in teams. There is also the chance to improve my skills in gathering and filtering the needed information in the context of self-study.

In the e-portfolio, I plan to show my results and problems I had while obtaining them. This should serve as a documentation of my progress. I would like to stay in close contact with the other members of the group to ensure a continuous exchange of information. We already have our own group in Mahara.

The installation of MATLAB, Simulink and all needed packages, toolboxes and libraries was straight forward, and no problems were encountered this far. At this point, I managed already to work on some tasks concerning the multibody simulation, that will be further carried out in my next reflection.



+Add comment Details

Entry Reflection

Posted by Thikshana Reddy Yeruva on 12 November 2021, 11:17
Tags: e-portfolio

From Bachelors, as a student of Mechanical Engineering, I was always enthusiastic towards exploring, participating and gaining knowledge in various branches of my course. Many opportunities in the form SAE college club, yearly technical events, workshops and racing events have been introduced to students. By taking the full advantage of these opportunities, from my participation in the events like preparing DIY 4 wheeled bots, bot racing ,terrain compatible bots, DIY go-kart challenges and to my final year project where we as a group built a quadcopter to function for agricultural purpose, also virtual development of a 2 legged robot (VPDT) from Summer semester 2021, my passion towards building robots have increased periodically which motivated me to choose System Level Rapid Development module in Mechatronics.

I am looking forward to learn setting up a two-wheeled robot and programming to run the robot in desired paths in MATLAB environment. Though I have a basic knowledge of MATLAB environment from previous semester in which we as a group have worked on multi body simulation of robot with controller in SIMULINK connected to hyperworks model using an S function block , the scope of this project seems distant as it helps to connect software setup to hardware setup which is a new area of learning for me as I will get exposure to new tool boxes, which helps in designing, analyzing and execution.

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Reflexionen (Theorie)

+ Add comment Details

Reflections

Posted by Marina Zingraf on 10 September 2020, 13:29
Last updated 29 September 2020, 9:44
Tags: eLearning, e-portfolio, Reflections

Reflection on your own learning process is a requirement for a successful portfolio. For this purpose, reflective blog entries have to be written for M1, M2, M3. In doing so, the students look back at what has been worked out so far: What has been learned should be put into an overall context and viewed critically.
The reflections should be scientifically based and combine knowledge and skills already acquired in other lectures and seminar units and in the Bachelor's programme. Or show which aspects have been neglected in learning so far and are taken up by the respective lecture.

Reflections can make visible the connection between product and process, i.e. between learning products and processes. Continuous identification and reflection of learning progress causes and promotes conscious acquisition of learning and professional competence. Students also learn to give constructive feedback, to accept it and if necessary to reject it, thus promoting the examination of their own work & self-confident acting becomes a basic requirement if one "dares" to contradict lecturers/colleagues with good reason.

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Reflexionen (Praxis)

+ Add comment Details

M2: Reflection

Posted by Florian Henn on 09 December 2021, 11:02
Last updated 09 December 2021, 20:33

Now the second part of the module reached it's end with the three chapters "State machines", "Code export" and "Setting up and testing the two-wheel robot". In comparison to the first milestone it was much harder and more time consuming. Especially the implementation of the MecRoKa library was a hard challenge for me and the whole group, but we managed that successfully.

The first chapter "State machines" wasn't completely new for me and in fact not hard. However, it was a good opportunity to review all that I had already learned last semester in "Simulation of Mechatronic Systems". New for me was the use of a truth table as a way of logical decision making. With the predefined example I got it fast and I haven't had much difficulties with that. I tried to work near to the demanded tasks and I tried to answer questions, which resulted out of the given subtopics. The chapter "Code export" in general was also not very hard to handle. Anyway, there were a lot of new things for me, like working with the Arduino platform, what was/is very interesting for me. Moreover, I worked the first time with additional libraries, what increased my experience in the work with MATLAB/Simulink. Towards the end of this chapter, a problem occurred regarding the MecRoKa library and the hardware upload, that we couldn't solve so quickly. The problem also affected the prepared controller software in the chapter "Setting up and testing the two-wheel robot", so the robot wasn't able to run. Finally, we weren't able to find the root cause for the issue, but we found a good temporary solution.

The most important thing during part of the module was the great work of our team. At the beginning no one struggled, because everyone has some experience in MATLAB. But when we got the problem with the library, we had several long meetings to get rid of it. Every team member was highly motivated and the issue increased the motivation. I'm very happy to work in this group and I'm sure, we will have a great time in solving the challenges of the third part of this module.

+ Add comment Details

Milestone 1

Posted by Yannick Raddatz on 04 November 2020, 10:27
Last updated 04 November 2020, 14:38
Tags: Control System Tuner, Milestone, Multi Body Simulation, Simulink

Milestone 1: Multibody Simulation and Control Design

This milestone entry covers Multi Body Simulation and Control Design. The setup of the software environment is not described further here, as this process is very straight forward.

The Multi Body Simulation was set up according to the steps in the manual. Furthermore, some minor modifications were implemented.

One of these modifications was that the red brick is partially transparent, so the motion of the pendulum is more visible in the Mechanics Explorer. By dividing the model into subsystems the mechanical model has become rather simple (see figure 1). It consists of a world subsystem defining the Mechanic Configuration and the Solver Configuration. The Prismatic Joint is then surrounded by a subsystem because it is framed by two transformations. Both bricks each have a masked subsystem. For the base only the mass can be specified. The pendulum, however, is adjustable in mass, length and initial angle. The initial angle is important to match the output of the angle from the Revolute Joint to ensure the vertical position is 0 degrees. The whole mechanical model itself has also been placed in a subsystem with the Actuation Force as input and the velocities and positions as outputs.

A closer look at the subsystems is not necessary, except for the Prismatic Joint.

The Prismatic Joint subsystem (see Figure 2) includes one Prismatic Joint and two Rigid Transformations. These are necessary because the Prismatic Joint can only be translated in Z-direction. However, the Z-axis of the World System is subject to gravity, which results in the model simply falling into a void if the transformation is not performed. In order for the red brick to move in its X-direction, the transformation prior to the joint is reversed. The transformations are set using the Aligned Axes method.

During the construction of this model no major problems were encountered, as the use of Simulink has already been practiced in various lectures by Prof. Dr.-Ing. Oliver Maier. The handling of the coordinate systems was trained in the lecture Robotik 1 by Dr.-Ing. Michael Kleer.

The construction of the controller hasn't been difficult, because it consists of only 4 Gains and one Subtract Block. The controller has also been packed into a subsystem (see figure 3). This figure displays the gain values generated by the Control System Tuner. The use of the Control System Tuner wasn't obvious at first. For this purpose the documentation of MatLab Tune a Control System Using Control System Tuner provided help. These are attached as a pdf-file. The gain blocks were specified as Blocks to Tune. However, the gain block for the base position wasn't included, because controlling to the position contradicts the target of velocity. Therefore this gain is fixed to 0. As tuning target a StepTrackingGoal for the Base Velocity was set, which defines a First Order Step Response with a time constant of 0.4 seconds. My observation is that tuning is dependent on the previous gain values. So it might be possible for the Gain values to change when re-tuning. The time constant was chosen in a way that the Actuation Force doesn't increase too much, because this force has to be applied by the actuators of the two-wheel robot. After tuning the simulation results were shown in video 1 and in figure 4. The speeds are reached and the pendulum does not fall over. A preset of a speed ramp would give neater results, because the preset does not change abruptly and the target difference remains moderate. This would also reduce the maximum force necessary. For the simulation the amount of force is not critical, because the actuator is not limited. In reality, each actuator is limited in its dynamics and maximum force as well as power.

In summary, the Multibody Simulation and Control Design has been completed and simulations have been performed for different controller values and masses as well as mass distributions. Not all of these are presented here. A distribution of the tasks in the group has not been considered reasonable, because fundamental skills ought to be developed here. Therefore each group member worked individually. However, the results were compared and the group members supported each other in case of problems. The Simulink File and the Control System Tuner Session is provided in the download Section of this Portfolio.

Attached files (1)

helpSystemTuner.pdf - [3 B]

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Reflexionen (Theorie)

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Closing Reflection

Posted by Marina Zingraf on 10 September 2020, 13:32
Tags: eLearning, e-portfolio, Reflections

Conclusion: detailed portfolio closing, review & outlook

Evaluation of the lecture and the own learning process - most important findings - new questions - outlook. The following questions can serve as a guideline for the final reflection:

- What benefits do I generate through the portfolio for myself and for others?
- In what other context can the portfolio be helpful (e.g. work/ other lectures/seminars)?
- What strengths and weaknesses have I identified in myself?
- Which topics were not sufficiently considered in the lecture and/ or in the portfolio?

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Reflexionen (Praxis)

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Closing Reflection

Posted by Keshav Prabhakar on 06 February 2021, 8:40
Last updated 06 February 2021, 9:04

I found this Module really interesting and got to learn a lot of new concepts through this module. I liked how we got to work on the robot hands-on, and could see our coded ideas immediately in action. Using Mahara as a tool to document one's learning curve is pretty good apart from some minor glitches in the tool that I faced. Although each member of the team received a robot, I missed peer-to-peer direct interaction and working together on the Robot, for example from the Laboratory. This would have allowed us to function better as a team and have effective brainstorming sessions. Although, to an extent we did do this digitally as well.

What I would have really liked additionally in the module, would have been for us to completely build up/assemble the robot from its individual components. This would have enabled us to understand better the hardware/components that go into building a Robot.

To sum up, I am really satisfied with this module, and would definitely recommend it to anyone who has an interest in Robotics and wants to learn more about them. The module also addresses typical scenarios that you might face later in your working career and hence prepares you well for those scenarios.

+ Add comment Details

Closing Reflection

Posted by Prabhu Karthik on 07 February 2022, 22:10
Last updated 07 February 2022, 22:39

Learnings:

The concept of working on task without any prior knowledge of it or any knowledge transfer from a colleague was the biggest knowledge I received from this course.

As a Masters student I understood how to approach like an Engineer to any process related system level rapid development.

The learnings are tremendous and as a beginner I've learnt how to use MATLAB and SIMULINK.

I also understood how a TWR works and what changes can be observed when any changes to its model in SIMULINK is done.

I also understood how to create a blog and update its progress over the time.

Plans prepared as a team to make sure tasks were completed before the deadline.

Strategies Used:

Since I've worked in auto industries in the past, I could implement similar kind of strategies to work with my teammates.

We first understood the task and we as a group tried to figure out what one's capable of doing.

We assigned tasks to each other and helped each other when an issue occurred. To be on same page, met on regular basis at Hochschule Kaiserslautern as well as over Zoom meetings.

We respected everyone's opinion and idea. We analysed the best possible solution and came to a conclusion based on practical methods.

The challenges we came across were mainly regarding task1 and task3, where we had to drive the robot a distance of 3meters as fast as possible and add an additional weight to the robot where it returns to its original position.

We spent more than 2 weeks to understand the concept of the TWC and implement our solution for task1 and 2 weeks for task3.

As a group we functioned really well and worked in complete harmony.

Contributions:

I was able to contribute for task2, task4 and as a member who could manage the progress, schedule meetings and implementation of the code by uploading and recording the videos at Hochschule along with other teammates.

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Feedback

- Individuell auf den Ersteller angepasst
- Kompetenzerwerb im Fokus
- 3 Arten des Feedbacks
  - Selbstreflexion
  - Peer-Feedback
  - Feedback einer Lehrperson

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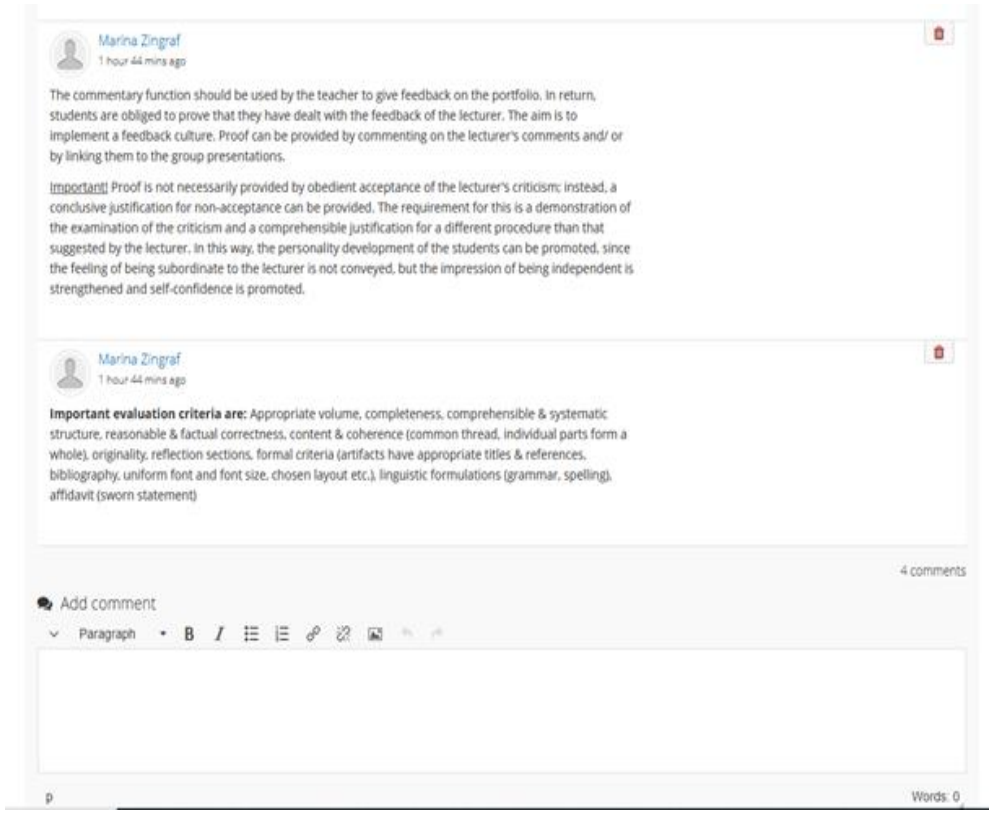
Feedback (Theorie)



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Feedback (Praxis)

Keshav Prabhakar (Prabhakar)
28 January 2021, 19:51

Hello Maximilian,

I went through your ePortfolio and I think it is well structured and easy to read. I like also how you have given references and I did end up watching a few of those youtube videos to gain some more insights into the matter.

It is really interesting that you tried to implement the Kalman filter to improve the state estimation. That was pretty new to me, and I learnt about it from your ePortfolio.

The time you achieved in Challenge 1 for covering the distance of 3m was impressive! I also like how you programmed the LED to light up and switch off after the 3m mark was reached. How did you although arrive at a maximum velocity value of *1.05 m/s*? Was it a limitation due to the logic of the controller or did you perform many trials and realise that *1.05 m/s* was the fastest the robot could go? I realise Challenge 1 is a bit loosely described with regard to the total distance the Robot can cover, but I would've liked to see how much time it would've taken the robot to cover a shorter distance(closer to say 3.5m) as compared to 5.8 m that your robot moves.(Since of course if you have a larger distance and a more gradual increment in speed, you can achieve a higher overall velocity.)

With regard to Challenge 2, I believe you could have simplified some aspects of the State-Chart a bit more. It took sometime for me to decipher what you were exactly doing in certain states. Also I believe it might have been cleaner, from the perspective of the Simulink model structure, if you had grouped the position logic which happens in the parallel state, inside of the controller model. In this way, the controller and all its associated logic sits together and the State Chart can be used to only set targets when needed. Also I was curious as to why the correction of 0.045 sec was necessary? To sum up, the time you achieved in this task I think is good as well.

I believe Challenge 3, could have been done better. Instead of adjusting/controlling the target speed as you have done, I think a distance approach - where you specify a set position and essentially command the robot to return back to that position - might have given you a better result.

I think you explained and did a good job for Challenge 4 as well.

As a small addition to your four Challenges, I think the animation results from the simulation would be a nice addition.
To sum up, I think you and your group did a really good job on the tasks as well as working as a team by dividing various activities/focus areas.

Best Regards,
Keshav

Maximilian Pfleger (Pfleger)
29 January 2021, 10:08

Dear Keshav,

thank you for taking the time to look in my portfolio.

Regarding your question about Challenge 1: The 1.05 m/s was only possible under the best conditions and it took many attempts to reach this value. At higher target speeds the robot always fell over. We didn't put any emphasis on the total distance, because that is not part of the task. It is certainly interesting to see what the robot can achieve over shorter distances, but we might not have been able to achieve this result in a shorter distance.

It is unfortunate to hear that you find my arrangement of the states for Challenge 2 too complicated. I tried to make it as simple as possible, but maybe you are right and it really is complex. I will try to make things like this clearer in the future. Thanks for the tip.

The position estimation part is intentionally not grouped together with the controller: The setting of the targets is done with a frequency of 20 Hz while the controller is executed with 200 Hz. There is no point in calculating the position so many times and then not use that value. With our implementation, the value is only calculated when it is needed. Your suggestion could give a more accurate result, but I think this aspect is negligible because this gain in accuracy is not likely to be very large.

The correction of 0.045 s has proven to be useful to perform a 360° rotation with greater probability. We have determined this by testing with different values.

As far as Challenge 3 is concerned, we actually control to position 0. A PI controller sets a default value for the speed depending on the position deviation (abs(pos) >= 0.01). The robot's ability to return to its original position is actually quite good.

I agree with you on the simulation results aspect. These were originally just a tool for me to test my code. What mattered to me was only the results with the real robot.

Kind regards,

Max

Co-funded by the
Erasmus+ Programme
of the European Union

Resümee

- Nachhaltiges Lerninstrument: „kompetente Studierende“
- Förderung von reflexiven Fähigkeiten
- Anregung von kreativen Prozessen
- Anknüpfung an digitale Lebensrealitäten
- Individualisierte Bildungsinhalte ermöglichen

vs.

- Hoher Zeitaufwand
- Abhängigkeit von digitalen Plattformen
- Subjektivität

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Kontaktinformationen

Marina Zingraf (M.A.)
Projekt XP2P-Peer-to-Peer-Learning in Mechatronics
E | marina.zingraf@hs-kl.de
WWW | https://xp2p-project.eu/
Mahara | Beispielportfolio

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