Digital UR+ Gripper

A gripper for the Universal Robots UR5 robot is to be developed during this semester project. An idea could be to follow the block diagram below, but not required.



It is expected that you at least develop:

* A 3D model of a gripper that can be printed or otherwise constructed.
* Electronics to control the gripper.
* A URCaps plugin for the UR controller.
* Software design of a C++ Program developed on a Raspberry PI, a PC, or possibly both.
* A modern communication interface to the gripper (e.g. OPC UA). Ideas to an interface:
* The no. of grips
* Gripper force
* Gripper distance
* Etc.

The gripper must fulfil the following requirements:

* Supply voltage: 24V (from external supply – **you are not allowed to use the** **robot controller as power supply**)
* The maximum gripper power use: 600mA
* It is not allowed to use the digital I/O from the UR robot. All I/O must be done through the Raspberry Pi microcontroller. Please remember that the power output from digital I/O is very limited.

# Evaluation

The final evaluation will be based on the following:

* Fulfillment of requirements
* Implementation of ideas and innovative solutions
* Documentation and individual examination of the project

# Resources

* DevLab <http://devlab.sdu.dk>
* SDU Library FabLab <http://www.sdu.dk/da/fablab>
* MMMI PrintLab (contact Cao Danh Do ([cdd@mmmi.sdu.dk](mailto:cdd@mmmi.sdu.dk)) for access and instructions)
* Motors
* <https://dk.rs-online.com/web/p/dc-motorer-jaevnstromsmotorer/9211464>
* <https://dk.rs-online.com/web/p/dc-motorer-jaevnstromsmotorer/9211458>
* <https://dk.rs-online.com/web/p/dc-motorer-jaevnstromsmotorer/9211442>
* RS Online (small components can be ordered by supervisor – within reasonable limits)
* OPC-UA library: <http://freeopcua.github.io/> (and a lot of different libraries)
* UR tutorials:
* Generic tutorials: <https://www.universal-robots.com/academy/>
* SDK for developing URCaps plugin (requires login)  
  <https://www.universal-robots.com/plus/developer/>
* Download the starter-package - a virtual machine with a UR simulator and UR SDK, or the SDK itself.
* <https://plus.universal-robots.com/download-center/urcaps-starter-package/>
* If running Linux, you might just get the SDK and download the UR offline simulator as a standalone software.
* <https://plus.universal-robots.com/download-center/urcaps-sdk/>
* You might get into problems with newer versions of Linux due to version incompatibility with Java. This might be solved by removing the explicit dependency in the install.sh script. (this was old news, but maybe still relevant)
* After installation of the SDK, there is a pdf in the “doc” folder with tutorials which we encourage you to study.

# Group members

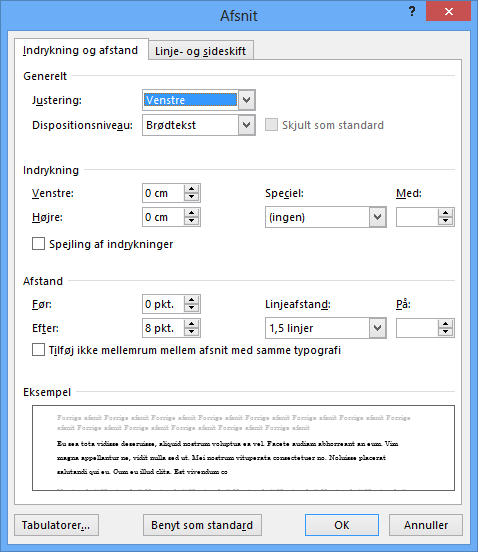
If group members decide to stop their studies or if group members for some reason are excluded, the group have to send an e-mail to Kamilla Juel Sørensen ([kjs@tek.sdu.dk](mailto:kjs@tek.sdu.dk)). You need to tell which person has dropped out followed by the reason given. Please discuss the case with your supervisor before send an e-mail.

In case of an inactive group member, please follow this procedure:

* Try to contact the group member using the student e-mail and set your supervisor as “cc” in the e-mail.
* Also try to reach the group member with other communication media phone, facebook, etc.

If it is impossible to get in touch with the group member, please discuss the case with the supervisor and send an email about the case to Kamilla Juel Sørensen (cc: the supervisor). She will then try to contact the inactive person. If the person is not eligible to be a part of the group, procedures will take action to exclude the person from further project work.

# Requirements to the report

The report must be written in English (unless your supervisor instructs you in Danish). The report needs to be written with footed fonts (e.g. Times New Roman, Century Schoolbook or equivalent). Top and bottom margins must be 3cm and side margins must total to 6cm (e.g. 2.5 and 3.5cm). It is recommended to keep one margin a bit wider than the other to keep room for notes.

A line spacing of approximately 1.5 is recommended. The accurate line spacing and font size is determined using the lorem ipsum text on the next page. This page is supposed to take up a complete A4 page with the given margins - no more, no less. Next page is written with Century Schoolbook font size 10, spacing of 8pt. after a section and line spacing of 1.5.

With these settings the report has a maximum page count of 30 pages (all inclusive). This is not a minimum, but a maximum. A good project does not need to be 30 pages.

The distribution of tasks among the group members must be stated in the report.

The report front page must be given a title, education, semester, group number, authors with birthday (NOT your CPR-number) and username, the name of your supervisor and the supervisor’s e-mail.

# Hand-in

Project must be handed in electronically on BlackBoard (SDU Assignment).

You are supposed to hand in one PDF with the report and a zip-file with source code, mathematica/matlab code, test documentation, supplemental material etc. In the report, there must be a list describing the contents of the zip-file. Please do NOT put the report in the zip-file. The report must be in a separate PDF file.

It is important that appendix, code, and material alike is put in a zip-file and the report is handed in as PDF since the report is automatically checked for plagiarism.

The report has a maximum size of 10MB. If the report is more than 10MB or handed in as part of the zip-file, the report will be treated as “NOT HANDED IN”.

The Zip-file with appendix and supplemental material can be more than 10MB.

Latest hand-in is Monday may 24th at 10:00. Please notice that the system automatically closes for hand-in.

# Exam

The exam is a conversation between supervisor and student of approximately 20 minutes including grading. The supervisor and group agrees on how the exam is executed in detail.

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