



Robotics: Final Project

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04.11.2024

Overview

- ▶ Motivation: practical experience with real hardware
- ▶ Team of two students
- ▶ Two options for the project
 - ▶ Cubes reorganization: pick-and-place with 6 DoF robot and vision
 - ▶ Drawing with a robot: draw with 4 DoF robot



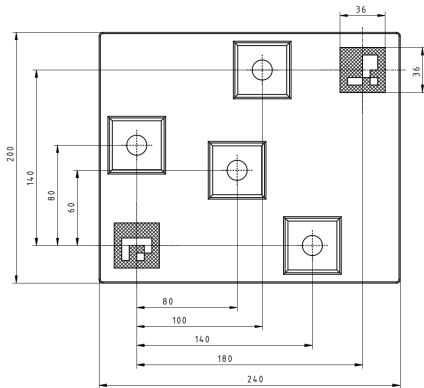
Option #1: Cubes reorganization

- ▶ External camera, 2 robots (CRS97, CRS93)



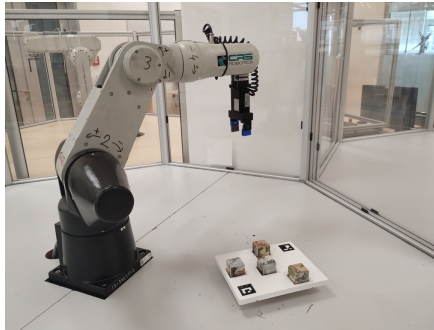
Option #1: Cubes reorganization

- ▶ Desks with Aruco markers on the top (CSV provided)
- ▶ Goal: transfer all cubes between holders



Option #1: Cubes reorganization, variants

- Variant A: planar problem, one desk (7 points)



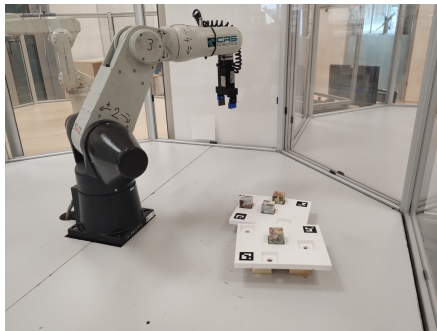
Option #1: Cubes reorganization, variants

- ▶ Variant A: planar problem, one desk (7 points)
- ▶ Variant B: planar problem, cubes reorganization (10 points)



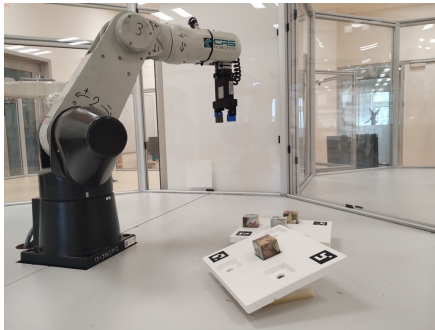
Option #1: Cubes reorganization, variants

- ▶ Variant A: planar problem, one desk (7 points)
- ▶ Variant B: planar problem, cubes reorganization (10 points)
- ▶ Variant C: non-planar problem (15 points)



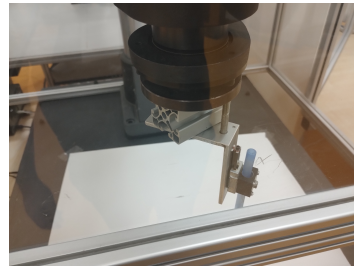
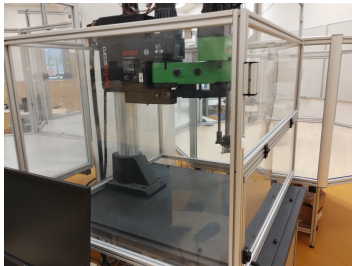
Option #1: Cubes reorganization, variants

- ▶ Variant A: planar problem, one desk (7 points)
- ▶ Variant B: planar problem, cubes reorganization (10 points)
- ▶ Variant C: non-planar problem (15 points)
- ▶ Variant D: rotation by 7 or 15 degrees (20 points)



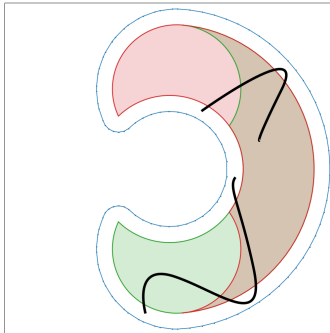
Option #2: Draw with a robot

- ▶ Draw curves from the image template
- ▶ No camera needed
- ▶ Robot Bosch (SCARA)



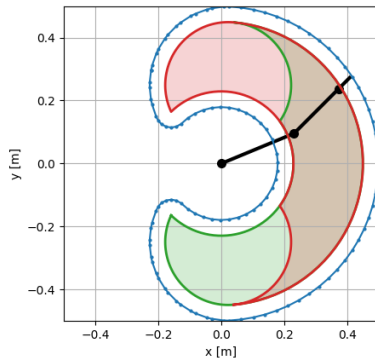
Input

- ▶ Input is an image that contains a curve
- ▶ Dimension of a iamge is 1000×1000 px
- ▶ 1 px corresponds to 1 mm



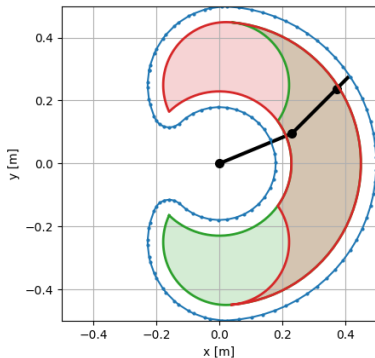
Option #2: Draw with a robot, variants

- Variant A-1: one curve in intersection of the red and green (4 points)



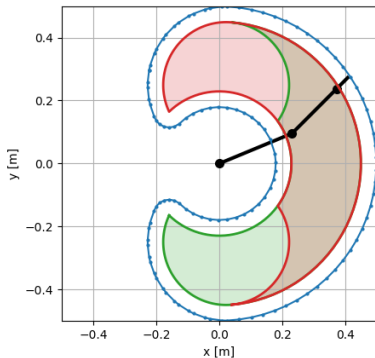
Option #2: Draw with a robot, variants

- ▶ Variant A-1: one curve in intersection of the red and green (4 points)
- ▶ Variant A-N: more curves (6 points)



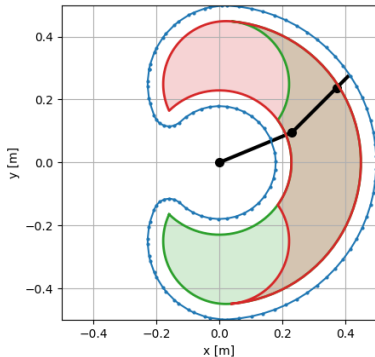
Option #2: Draw with a robot, variants

- ▶ Variant A-1: one curve in intersection of the red and green (4 points)
- ▶ Variant A-N: more curves (6 points)
- ▶ Variant B-1/N: one curve in either red or green (6/7 points)



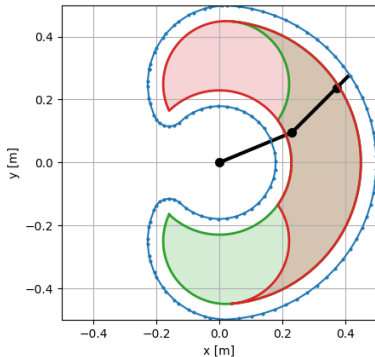
Option #2: Draw with a robot, variants

- ▶ Variant A-1: one curve in intersection of the red and green (4 points)
- ▶ Variant A-N: more curves (6 points)
- ▶ Variant B-1/N: one curve in either red or green (6/7 points)
- ▶ Variant C-1/N: one curve in union of red and green (8/10 points + 1 point for continuity)

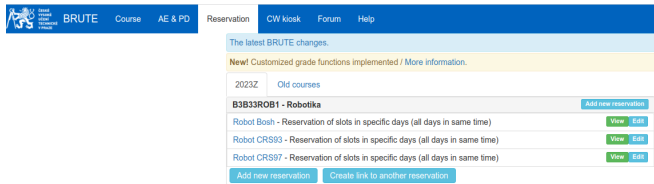


Option #2: Draw with a robot, variants

- ▶ Variant A-1: one curve in intersection of the red and green (4 points)
- ▶ Variant A-N: more curves (6 points)
- ▶ Variant B-1/N: one curve in either red or green (6/7 points)
- ▶ Variant C-1/N: one curve in union of red and green (8/10 points + 1 point for continuity)
- ▶ Variant D-1/N: one curve in robot workspace (blue) (14/15 points)



- Sharing the resources: reservation system in BRUTE



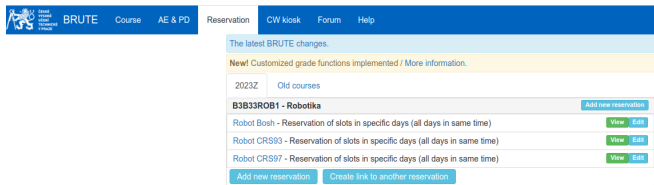
The screenshot shows the BRUTE reservation system interface. At the top is a blue navigation bar with the text "BRUTE" and links for "Course", "AE & PD", "Reservation", "CW kiosk", "Forum", and "Help". Below the navigation bar, there is a section titled "The latest BRUTE changes." followed by a yellow banner announcing "New! Customized grade functions implemented / More information." Below this, there are tabs for "2023Z" and "Old courses". The "2023Z" tab is selected, showing a list of reservations for the course "B3B33ROB1 - Robotika". The list includes three entries: "Robot Bosh - Reservation of slots in specific days (all days in same time)", "Robot CRS93 - Reservation of slots in specific days (all days in same time)", and "Robot CRS97 - Reservation of slots in specific days (all days in same time)". Each entry has "View" and "Edit" buttons. At the bottom of the list, there are buttons for "Add new reservation" and "Create link to another reservation".

B3B33ROB1 - Robotika		Add new reservation
Robot Bosh - Reservation of slots in specific days (all days in same time)	View Edit	
Robot CRS93 - Reservation of slots in specific days (all days in same time)	View Edit	
Robot CRS97 - Reservation of slots in specific days (all days in same time)	View Edit	
Add new reservation		Create link to another reservation



Laboratories

- ▶ Sharing the resources: reservation system in BRUTE
- ▶ Consultations
 - ▶ During the labs: one of TAs (Krsek, Smutny) is prepared on a phone
 - ▶ Other timeslot: contact all TAs by email



The screenshot shows the BRUTE reservation system interface. The top navigation bar includes the BRUTE logo, a search bar, and links for Course, AE & PD, Reservation, CW kiosk, Forum, and Help. Below the navigation bar, there is a section for the latest BRUTE changes, followed by a notification about customized grade functions. The main content area displays a list of courses for the 2023Z semester, with a tab for 'Old courses'. The first course listed is 'B3B33ROB1 - Robotika', which has an 'Add new reservation' button. Below this, there are three reservation entries: 'Robot Bosh - Reservation of slots in specific days (all days in same time)', 'Robot CRS93 - Reservation of slots in specific days (all days in same time)', and 'Robot CRS97 - Reservation of slots in specific days (all days in same time)'. Each entry has 'View' and 'Edit' buttons. At the bottom of the list, there are buttons for 'Add new reservation' and 'Create link to another reservation'.



Delivering final project

- ▶ Technical report and demonstration
- ▶ Report needs to be uploaded in advance
- ▶ Reservation system for the last week of the semester and exam-period
- ▶ **Contact us if you want to deliver sooner**

