MRC 2021
Tooling and Infrastructure

Bob Hendrikx

Eindhoven University of Technology
Department of Mechanical Engineering

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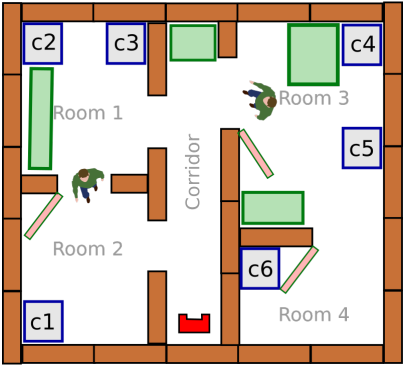
The Assignment

Final Competition: Bring items to cabinets in a dynamic hospital environment, of which a map is provided

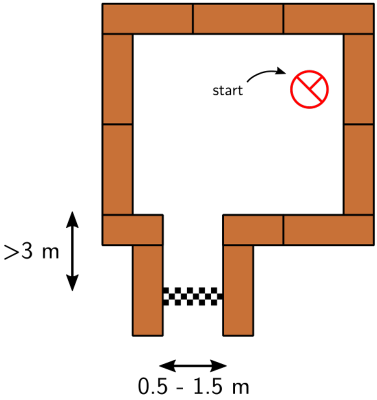
- Goal:
  - visit an unknown number of cabinets as fast as possible
- You can use:
  - The Laser Range Finder to detect walls and doors
  - The encoder data from the wheels
  - ~~The control effort signal to notice touches~~
- Important Dates:
  - Final Presentations: June 2
  - Competition Day: June 9



Intermediate Assignment

Escape Room Competition: let a robot escape the room through the door.

- Goal:
  - try to be as fast as possible
- You can use:
  - The Laser Range Finder to detect walls
  - The encoder data from the wheels
  - The ~~control effort signal to notice touches~~
- Competition day: May 12



Simple, right?

Don't worry, we supply you with some tools to get you started!

Introducing the Robot: PICO

- Unfortunatly we cannot use it!
- Telepresence Robot from Aldebaran
  - Robot type: Jazz
- Sensors:
  - Laser Range Finder (LRF)
  - Wheel encoders (odometry)
  - 170° wide-angle camera
- Actuators:
  - Holonomic base (omni-wheels)
  - Pan-tilt unit for head
- Computer:
  - Intel I7
  - Running Ubuntu 16.04

ROS

- Robot Operating System
  - Open-source meta-operating system for robots

- Won't be using it!
- Instead, we will provide our own 'software layer'
  - It is simpler to understand, and 'cleaner' to use
- However, you are still allowed to use ROS!

Ubuntu

Development of PICO's software will be done in Ubuntu.

- Linux-based operating system
- Use version **18.04** (16.04 and 20.04 are at own risk)
- 32- and 64-bit (64-bit recommended)
- Easy dual boot installation with *e.g.*, Windows
- Download: see tutorial!
  - Any problems? → Check the wiki.
  - No info? → Send us an email.

C++

- We will use C++ as programming language
- C++ is object-oriented C
  - "C with Classes"
  - Encapsulate data and functionality within objects
- It is a powerful but complex programming language.
- However, we provide you the MRC framework to get you started

Creating code: Qt Creator

- Integrated Development Environment
  - Advanced code editor
- Many advantages over ‘simple editors’:
  - Syntax highlighting
  - Code completion
  - Visual compiler feedback
  - Static code checking
  - Refactoring tools
  - Parenthesis matching
  - ...
- Or your own favorite editor that supports CMake..

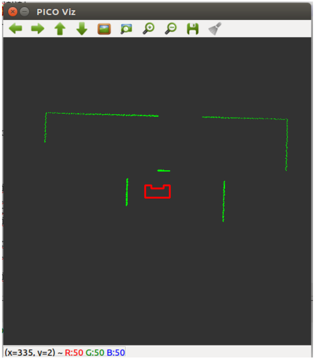
Git Version Control

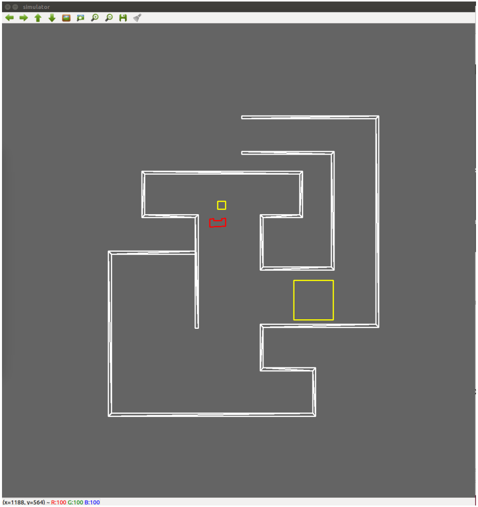
- Version Control System:
  - *'Manages files and directories, and the changes made to them, over time'*
- Used to store and maintain your code on the server
  - (Like Dropbox)
- Maintains version history
- Is distributed
  - You always have the full history on your pc
  - You can always go back to a version, show differences, even when off-line
- More info on the Wiki

PICO Simulator

- The simulator will be used to replace the real robot.
- PICO Simulator:
  - Simulates:
    - Sensors (Laser, odometry)
    - Actuators (Base)
    - Environment (walls, objects)
- Can easily create test environments using height maps
- Integrates well with our provided software
  - If your software runs in the simulator, it runs on the robot

PICO Simulator





Example

- Full Example: from requirements, through Task-Skill-Motion to Software Executable.
- (far) from perfect!
- Focus on decoupling parts of functionality, explicitly in the code.

Tutorial lectures will introduce robotics concepts in more detail!

Wiki

- MRC Wiki:
  - http://cstwiki.wtb.tue.nl /index.php?title=Mobile_Robot_Control
  - Info on practical assignment, installation, getting started
  - Log-in: student account
- Group pages on EMC Wiki:
  - Each group gets its own page
  - Update at least weekly
- Overall use:
  - Everyone can edit
  - If you see a mistake: correct it

Working together

Because working together face-to-face is not possible:

- We recommend using Microsoft Teams within your group
- Meet with your tutor once every week using video call
- Use canvas for asking general MRC questions to tutors and fellow students
- Use canvas for FAQ about problems (e.g. dual boot issues)
- If you had a problem and know how to fix it: add it
- Use canvas to discuss the video lectures

Recap

- Robot: Simulator only
- OS: Ubuntu 18.04
- Programming language: C++
- Code editor: Qt Creator
- Version control: git
- Documentation: Wiki
- meetings: Microsoft Teams
- General questions and discussion: Canvas

That should get you started!

Groups

Each group will be supervised by a tutor:

1. Manuel Munoz Sanchez
2. Peter van Dooren
3. Jordy Senden
4. Hao Liang Chen
5. Bob Hendrikx
6. Manuel Munoz Sanchez
7. Peter van Dooren
8. Jordy Senden
9. ..
10. ..
11. ..
12. ..

It is *your* responsibility to get in touch with your tutor (see Wiki)

What should I do now?

- Make your own groups of max. 6 people
  - By adding your name and contact info to one of the groups on the wiki
  - Send an email to your group members to get in touch
- Send an email to your tutor as a group:
  - to schedule the first meeting,
  - with one username for access to your Git, (tutorial)
- Check the Wiki & Finish the Tutorials:
  - `http://cstwiki.wtb.tue.nl/index.php?title=Mobile_Robot_Control`