Robot Programming with Lisp

1. Introduction, Setup

Arthur Niedzwiecki

Institute for Artificial Intelligence
University of Bremen

21st October, 2021

General Info

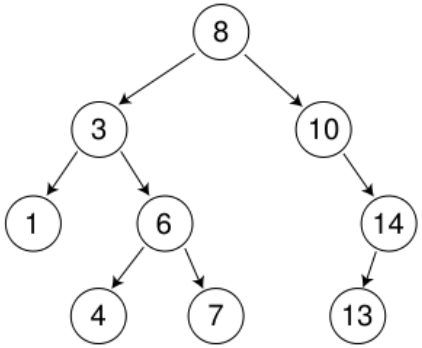
- Lecturer: Arthur (PhD student at IAI)
- Tutor: Vanessa (PhD student at IAI)
- Correspondence: `aniedz@cs.uni-bremen.de`, `hassouna@uni-bremen.de`
- Dates: Thursdays, 14:15 - 15:45, 16:15 - 17:45
- Language: English and German
- Credits: 6 ECTS (4 SWS)
- Course type: practical course
- Course number: 03-BE-710.98b
- Location: TAB Building, Room 0.36 EG

Plan

Course content

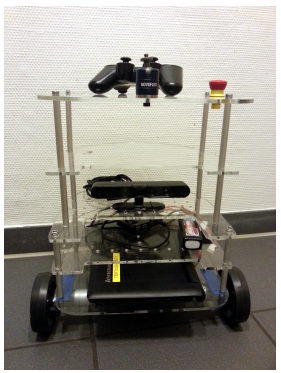
Common Lisp

Artificial Intelligence



Robot Operating System (ROS)

Robot platform



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Applications using / written in dialects of Lisp:
Emacs, AutoCAD, Grammarly, Mirai (Gollum animation), Google ITA (airplane ticket price planner AI), DART (DARPA logistics AI), Maxima (computer algebra system), AI frameworks, NASA satellites ...

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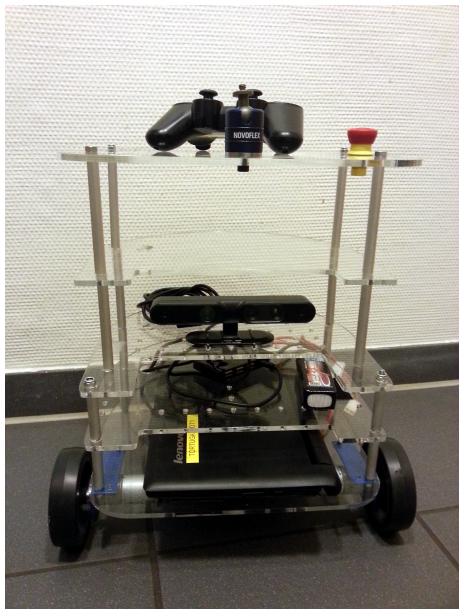
- *De facto* standard in modern robotics

TortugaBot

- 2 controllable wheels
- 2D laser scanner
- Thinkpad E485 PC with bluetooth
- PlayStation joystick



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- Lisp is good for rapid prototyping
- It is more suitable for symbolic reasoning and AI
- There are existing robot programming languages in Lisp that automate decision making

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- Lisp basics
- OOP & Failure Handling
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Project (groups, Jan-Feb '22)

- Controlling TortugaBot
- Reading sensor data
- Collision avoidance
- Heuristic decision-making
- The big day: competition

Software requirements

Bringing a *personal laptop* is encouraged.

OS:	Ubuntu 18.04 (or any Linux with bootstrapped 18.04)
IDE:	Emacs 24+
Version control:	Git
Packaging system:	ROS
Lisp software:	SBCL compiler, ASDF build system, Emacs plugin for Common Lisp

Bottom line

You will learn / improve your skills in the following:

- Linux
- Git
- Emacs
- Functional programming
- Common Lisp, of course
- ROS (for future roboticists)

...and get to play with a real little robot!

Plan

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- Bonus points for very good homework solutions.

Links

- Emacs cheat sheet:

  `https://www.gnu.org/software/emacs/refcards/pdf/refcard.pdf`

- Git reference book:

  `http://git-scm.com/book/de`

- Lisp books:

  `http://landoflisp.com/`, `http://www.paulgraham.com/onlisp.html`, `http://www.gigamonkeys.com/book/`

Info summary

Next class:

- Date: 28.10
- Time: 14:15 (14:00 - 14:15 for questions)
- Place: same room (TAB 0.36)

Assignment:

- Due: 27.10, Wednesday, 23:59
- Points: 3 points
- For questions: write an email to Vanessa or Arthur

Plan

Assignment goals

Set up your working environment

Set up your Git repositories

Get comfortable with Emacs

Task 1: Install Ubuntu: General

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- MacOS
  Dual-boot or VM with VirtualBox (if Mac is incompatible)

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  (`ubuntu-18.04.6-desktop-amd64.iso`)
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- When in doubt, try 18.04 first, we'll need it anyway.
  Follow the steps on the next slide and do
  'Try out Ubuntu' instead of installing.
  Press the Super-Key (Windows-Key) and search for 'About'.
  If the graphics driver is **not** llvmpipe, your machine supports 18.04.

Task 1: Install Ubuntu: Installation

- Create a boot USB with the `.iso` (or burn a DVD).
  Hint: In Windows use the Universal USB installer:

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- Reboot with the USB plugged in to install Ubuntu.
  Dual boot installation with default settings is a one click thing.

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- Remeber to stay in the 18.04 'jail' for everything regarding this lecture.

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- Install the workspace management tools:

```
sudo apt install python-rosdep python-rosinstall python-rosinstall-generator python-wstool build-essential
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- Update your bash startup script and make sure it worked:
  ```
  echo -e "\n# ROS\nsource $HOME/ros_ws/devel/setup.bash\n" >> ~/.bashrc && tail ~/.bashrc && source ~/.bashrc
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- Download the course material into your ROS workspace:

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- Define a remote target with the address of your new GitLab repo:

  ```
  cd lisp_course_exercises
  git remote add my-repo https://gitlab.informatik.uni-bremen.de/YOUR_GITLAB_USERNAME/lisp_course_exercises.git
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- Once created, in "Members" add "Arthur Niedzwiecki" and "Vanessa Hassouna" as collaborators. "Project Access" is master.
- Install Git:

  ```
  sudo apt-get install git
  ```

- Download the course material into your ROS workspace:

  ```
  roscd && cd ../src
  git clone https://gitlab.informatik.uni-bremen.de/lisp-course/lisp_course_exercises.git && ll
  ```

- Define a remote target with the address of your new GitLab repo:

  ```
  cd lisp_course_exercises
  git remote add my-repo https://gitlab.informatik.uni-bremen.de/YOUR_GITLAB_USERNAME/lisp_course_exercises.git
  ```

- Upload the files to your new GitLab repo:

  ```
  git push -u my-repo master
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Task 4 (alternative): Git and GitHub

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Task 5: Install the IDE

- Install the editor itself (Emacs), the Common Lisp compiler (SBCL), the linker (ASDF) and the Emacs Common Lisp plugin (Slime):

```
sudo apt-get install ros-melodic-roslisp-repl
```

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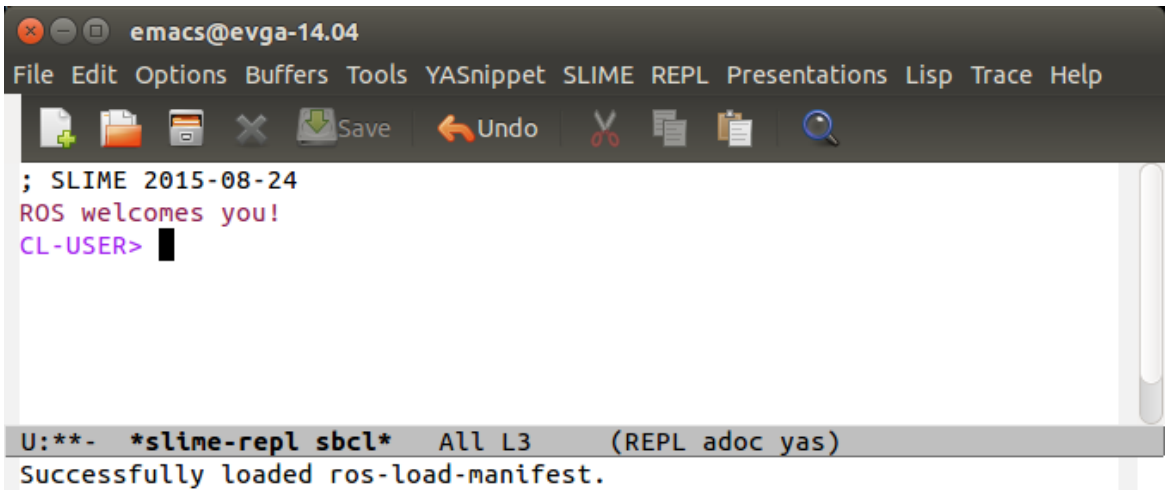
sudo apt-get install ros-melodic-roslisp-repl
```

- Start the editor (after compilation is finished you'll see the Lisp shell):

```
roslisp_repl &
```



Task 6: Get familiar with Emacs

The following notation is used in Emacs for keyboard shortcuts:

- `C` for `<Ctrl>`
- `M` for `<Alt>`
- `SPC` for `<Space>`
- `RET` for `<Enter>`
- `-` for when two keys are pressed together (e.g. `C-x` for `<Ctrl>+x`)

The basic shortcuts you will need are listed below:

- `C-x C-f` opens a file
- `C-x 3` or `C-x 2` opens a new tab, `C-x 0` closes it, `C-x 1` maximizes
- `C-x o` switches between tabs
- `C-x b` switches buffers, `C-x C-b` lists all open buffers, `C-x k` kills
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Open the file with your first assignment and follow the instructions:

`ROS_WORKSPACE/src/lisp_course_exercises/assignment_1/src/orc-battle.lisp`

Task 7: Get familiar with Git

- Once done editing `orc-battle.lisp`, check what's new in your local repo (the one on your hard drive):

```
cd ROS_WORKSPACE/src/lisp_course_exercises && git status
```

Task 7: Get familiar with Git

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git diff
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git commit -m "A meaningful commit message."
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- Once you're sure the changes are final, commit locally:

```
git commit -m "A meaningful commit message."
```

- Finally, to upload your local commits to the GitLab server, push the changes upstream:

```
git push # or git push my-repo master
```

Q & A

Thanks for your attention!