Robot Programming with Lisp

1. Introduction, Setup

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Institute for Artificial Intelligence
University of Bremen

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General Info

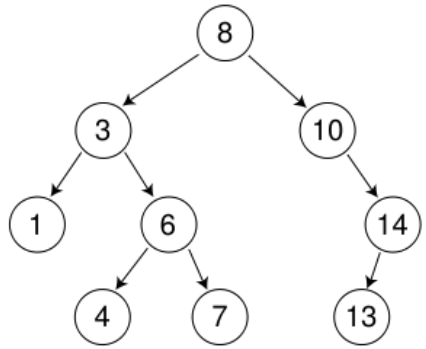
- Lecturer: Gaya (PhD student at IAI)
- Tutor: Arthur (HiWi at IAI)
- Correspondence: gaya@cs.uni-bremen.de, artnie91@cs.uni-bremen.de
- Dates: Thursdays, 14:15 - 15:45, 16:00 - 17:30
- Language: English and German
- Credits: 6 ECTS (4 SWS)
- Course type: practical course
- Course number: 03-BE-710.98d
- Location: TAB Building, Room 0.31 EG

Plan

Course content

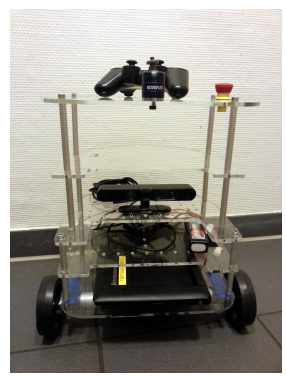
Common Lisp

Artificial Intelligence



Robot Operating System (ROS)

Robot platform



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

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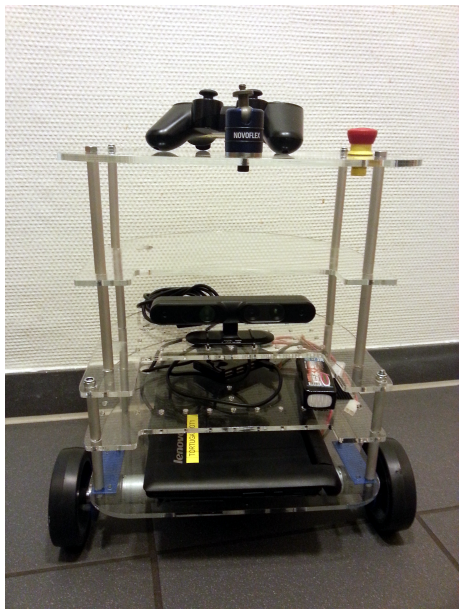
- *De facto* standard in modern robotics

TortugaBot

- 2 controllable wheels
- 2D laser scanner
- Optional 2.5D vision sensor
- Asus Eee PC with bluetooth
- Optional basket in the top part
- 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

Rough schedule

- Introduction, Setup

- Lisp basics
- Functional programming
- OOP

- ROS, ROS Lisp API (*roslisp*)
- *roslisp*, 2D world of *turtlesim*
- coordinate frames, *tf*

- TortugaBot, navigation
- Collision avoidance
- Project scenario
- Project implementation
- The big day: competition

Software requirements

Bringing a *personal laptop* is encouraged.

OS:	Ubuntu 16.04 or 14.04 (other Linux versions might work but with no guarantee)
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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- Final grade: 50 of 100 points - 4.0, 100 of 100 points - 1.0.

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- Bonus points for very good homework solutions.

Links

- Emacs cheat sheet:

  `http://www.ic.unicamp.br/~helio/disciplinas/MC102/Emacs_Reference_Card.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: 26.10
- Time: 14:15 (14:00 - 14:15 for questions)
- Place: same room (TAB 0.31)

Assignment:

- Due: 25.10, Wednesday, 23:59
- Points: 3 points
- For questions: write an email to Arthur or Gaya

Plan

Assignment goals

Set up your working environment

Set up your Git repositories

Get comfortable with Emacs

Task 1: Install Ubuntu 16.04

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- Burn the `.iso` onto a DVD or create a boot USB.
  Hint: for a bootable USB, in Windows use the Universal USB installer:
  `http://www.pendrivelinux.com/universal-usb-installer-easy-as-1-2-3/`;
  and in Linux you could, e.g., use the Startup Disk Creator or `unetbootin`.

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  `http://www.pendrivelinux.com/universal-usb-installer-easy-as-1-2-3/`;
  and in Linux you could, e.g., use the Startup Disk Creator or `unetbootin`.
- Install Ubuntu 16.04 (aka Xenial).
  Dual boot installation with default settings is a one click thing.

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  You should restart into the "Boot Options Menu" of your Windows:
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- *My BIOS supports UEFI, Ubuntu won't install!*
  It should work but if you can't get it to run turn off the UEFI mode:
  restart into the "Boot Options Menu" of your Windows,
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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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- Upload the files to your new GitLab repo:

  `git push -u my-repo master`

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- Compile the CRAM code (and assignment code):

```
cd ..  && catkin_make
```

Task 6: 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-kinetic-roslisp-repl
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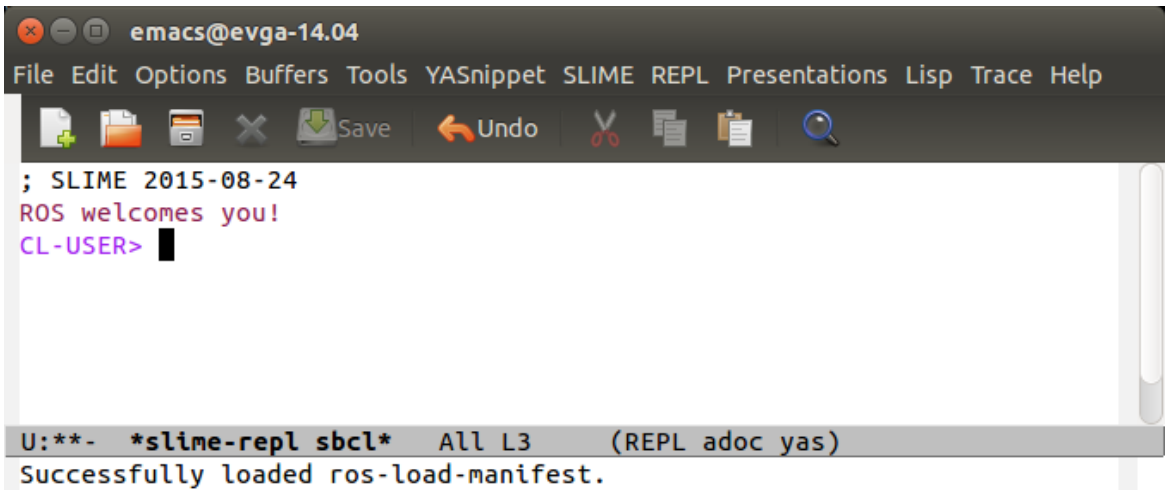
- Start the editor (after compilation is finished you'll see the Lisp shell):

```
roslisp_repl &
```



Task 7: 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
- `C-g` cancels a command half-way, `C-x C-c yes` exits Emacs

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Open the file with your first assignment and follow the instructions:

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

Task 8: 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_material && git status
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Task 8: Get familiar with Git

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

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

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- Install the compiler:
  `sh install.sh`

Q & A

Thanks for your attention!