



LUNDS
UNIVERSITET

Process Demo

Cool Department Toys

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Agenda

(A subset of) our department toys

- *Omnibots*
- *Lego Mindstorm*
- *GoPiGo*
- *Spot*



Omnibots



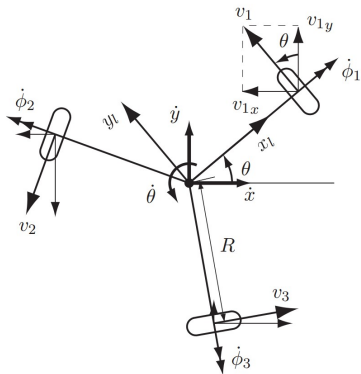
(a) Robot frame, raspberry pi, battery, servos, crazyflie



(b) Positioning through lighthouse system and crazyflie



(a) Power supply



(b) Nice and clean dynamics



Omnibots

But how do we control it?

- *Robot controlled through raspberry pi (raspian)*
- *Python-based interface between raspberry pi, crazyflie and servos*
 - *cflib - Crazyfly library*
 - *dynamixel - Blondell's python wrapper*
https://gitlab.control.lth.se/anders_blondell/dynamixel
- *SSH-connection via router to raspberry pi*



Learning Based Control-lab

Motion planning with "car dynamics"

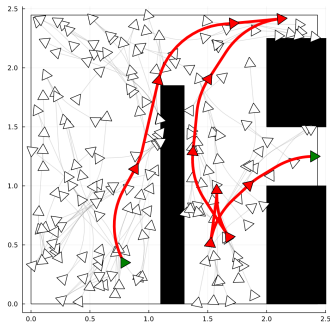


Figure: RRT-generated path



Learning Based Control-lab

Path-tracking video





Omnibots

Future:

- *Mass production*
- *Real-time systems projects*
- *MSc project in drone formation control (as a landing platform)*
- *Documentation at*
<https://gitlab.control.lth.se/regler/omnibots>
- *Cool potential projects*
 - *Connect with e.g. xbox-controller*
 - *Real-time vision-based state feedback*



Lego Mindstorm

- *Build-a-process*
- *"Base" is an "ev3-block"*
- *Tons of components*
 - *motor*
 - *gyroscope*
 - *beacon/sensor*
 - *ultrasonic sensor*
 - ...
- *Pairable with bluetooth (?)*
- *Program in python*
<https://pybricks.com/ev3-micropython/>



(a) Ev3-block



(b) Crazy robot



Backup Video

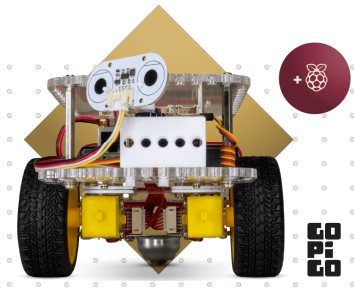
Lego Mindstorm Segway (phone control) - video





GoPiGo mobile robot

- Popular educational robot platform developed by Dexter Industries in 2014, since 2019 owned by Modular Robotics
- Controlled by a Raspberry Pi 3
- Dexter OS (preinstalled) or Raspbian OS (preferred)
- Wifi, Ethernet, USB communication
- Two DC motors, large range of possible sensors (distance, accelerometer/gyro, camera, ...)
- Suitable for exploring vision, learning, sensor fusion, planning, control, ...
- \$249 per standard kit (without camera)
- We have four kits with most parts intact

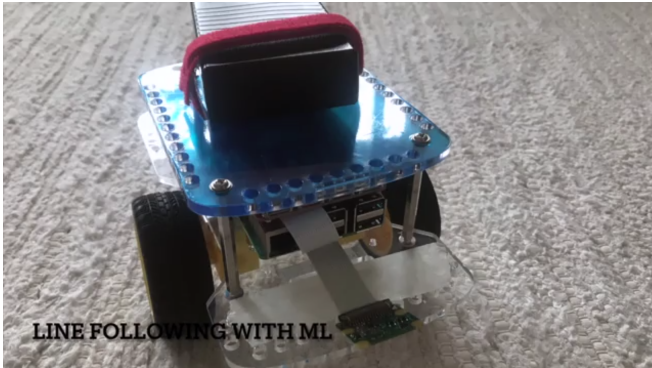


- <http://gopigo.io>



Projects in learning and control

Vision based path tracking - video





Spot

- Produced by Boston Dynamics
- Cameras, joints, motors, back payload
- (at least) WiFi connection (?)
- Python SDK for programming:

<https://dev.bostondynamics.com/readme>

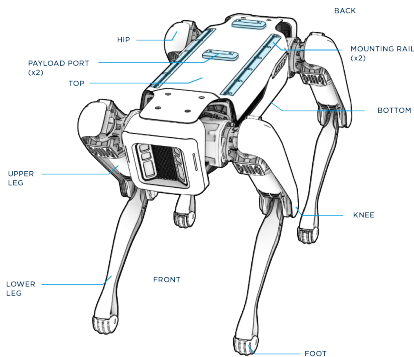


Figure: Spot anatomy (source https://dev.bostondynamics.com/docs/concepts/about_spot)



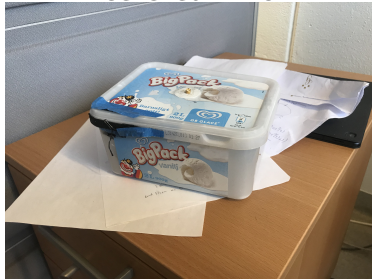
Mountable Extensions

Arm



- *Allows interaction with environment*
- https://www.youtube.com/watch?v=BMPWxcc-Xbk&ab_channel=SouthChinaMorningPost

Ice Cream Box

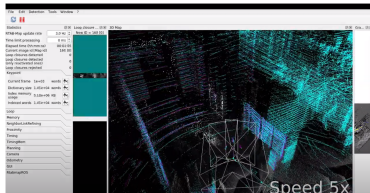


- *Provides GNSS positioning*
- *Connectable via duct tape*
- *(There's actually a SWEPOS-connected GNSS-receiver in there.)*



MSc project - Build Site Surveying

- MSc Thesis Project by Ola Nilsson
- Goal: Use Spot to survey build site
- Video:
https://www.youtube.com/watch?v=0PrDsm4PlZg&ab_channel=OLANILSSON
- Presentation: TBD (prel. 24/3 10:30)





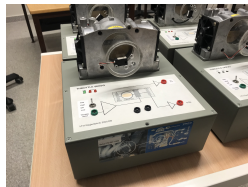
Honorable Mentions



(a) Furuta Pendulum



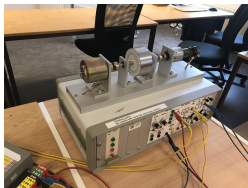
(b) Ball and Beam



(c) ???



(d) Mini Segway



(e) Servo



(f) Flexible Servo and Tanks



Thank you!

Questions? Suggestions?