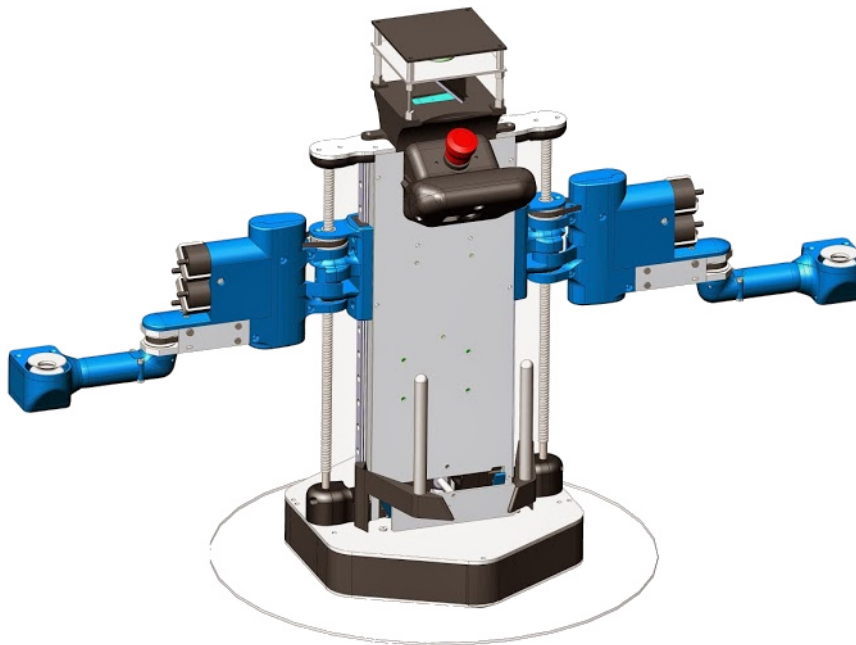


CLUB VAUDOIS DE ROBOTIQUE AUTONOME

Eurobot 2015 : Pilot Study



September 8, 2015

1 General information

- This project study can be published before the contest.
- Team name : CVRA (Club Vaudois de Robotique Autonome).
- Team location : Renens, Switzerland.
- Budget : About 3000 CHF, plus sponsors.

2 Robots

This year the club will engage two robots, The first one will have two arms, a differential drive and has code name *Debra 5*, since it is the fifth evolution of this design. The small robot hasn't got a name yet. Both robot share a common architecture, except for the arms, replaced by mission-specific actuators in the small robot. In this document only points shared by both robots are presented since the design of the mission specific part is not finished yet.

Motors Our robots each use two Faulhaber 2232-012-SR motors with a 20:1 reduction, rated at 8.7 W at 12 V, overvoltage at 14.8 V. Those motors allow us to use our max acceleration (wheel slippage) to 0.8 ms^{-1} . Each motor in the robot has an associated motor control board and processor, which will be presented later.

Positioning The robots use standard dead reckoning algorithms for positioning itself. A second pair of wheel, separate from the motor wheels, is used in order to avoid slippage under acceleration or shocks.

Opponent detection Our robots have two different avoidance systems. The first one is based on a rotating laser placed on opponent beacons, which allows to have absolute positioning. The second one is based on a reflex sensor embedded in our robot which detects a reflector on the opponent system. The redundancy allows for emergency stop in case of failure of the first one or of the pathfinding algorithm.

Power supply The robot is powered by a single 14.8 V lithium-polymer battery, which gives us a run time of at least 40 min.

Computing We have three different layers of computing in this year architecture (fig. 2):

1. An x86-based embedded PC running Linux is used for game decisions and path planning.
2. The realtime control is done on an ARM board which communicates with the PC using an IP/Ethernet link.
3. Finally each motor has a motor control board connected to it, which is responsible for speed and torque control, motor protection etc. Communication with the main board is done via a CAN bus running at 1 MHz.

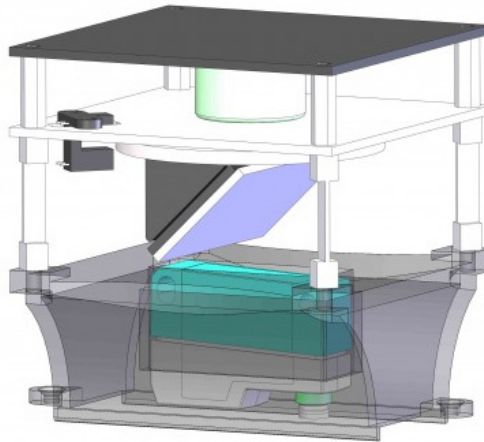


Fig. 1: Fallback beacon system. A reflex-type industrial sensor is mounted in the base (blue). It emits a LED beam (not laser), which is reflected on the rotating mirror (purple). A reflector is placed on the opponent robot, which allows for reliable detection. An index sensor (upper left, black) allows the robot to know the relative angle to opponent.

This software architecture allows us to easily scale to any number of actuators or sensors in one robot (up to 127 motors per CAN bus/master board).

3 Lasers

We have two different laser sources in the robot:

1. The laser rangefinder (LIDAR). This system is certified class 1 by the manufacturer and wasn't modified in any way. The datasheet of the system will be provided on contest day.
2. Main opponent detection system. This laser source was taken from a class 2 laser device but our use of the source puts it in class 1. This system was certified by the Swiss authorities (METAS) as class 1. The certification will be provided on contest day.

4 Team members

- Antoine Albertelli, 21: Software engineer.
- Florian Reinhard, 21: Software engineer.
- Patrick Spieler, 22: Software engineer.
- Michael Spieler, 21: Software engineer.
- Pius von Däniken, 23: Software engineer.

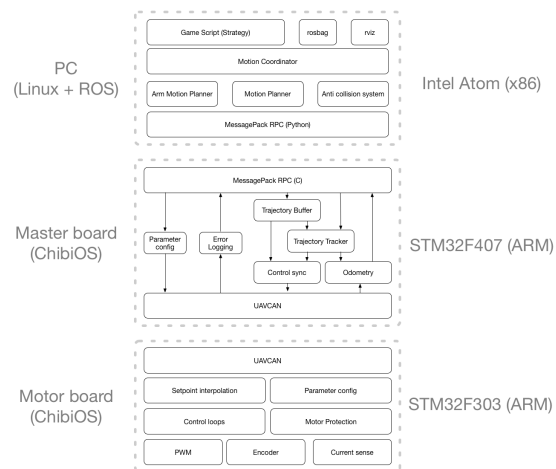


Fig. 2: Software architecture of our robot.

- Romain Bersier, 29: Mechanical engineer, Debra.
- Boris Pillionnel, 23: Mechanical engineer, Nastya.
- Guillaume Schaufelberger, 19: Mechanical engineer, Nastya.
- Mathieu Rouvinez, 29: Machining
- Jessica Schmid, 20: Electrical engineer.
- Dominik Reukauf, 24 : Mechanical Engineer.