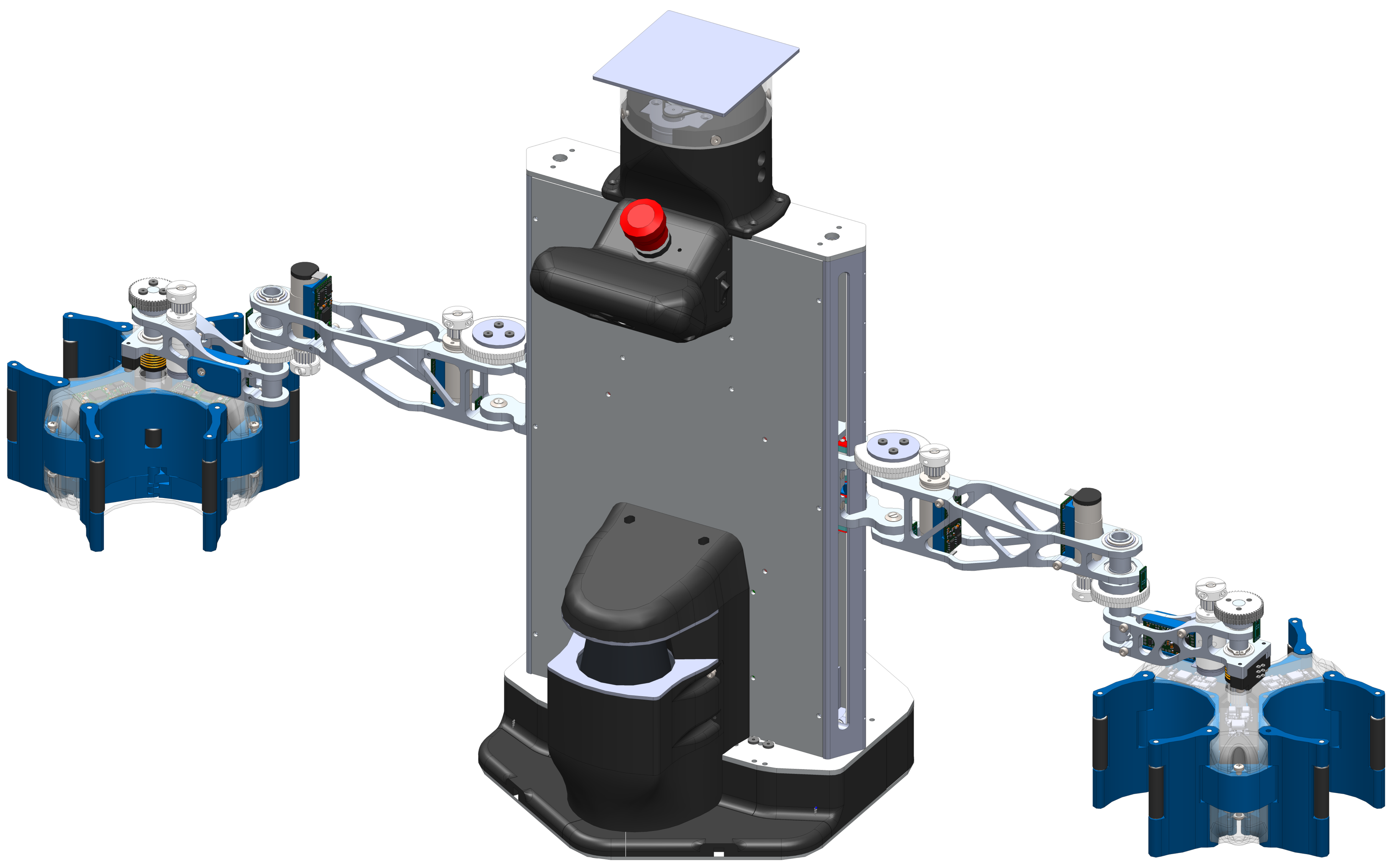
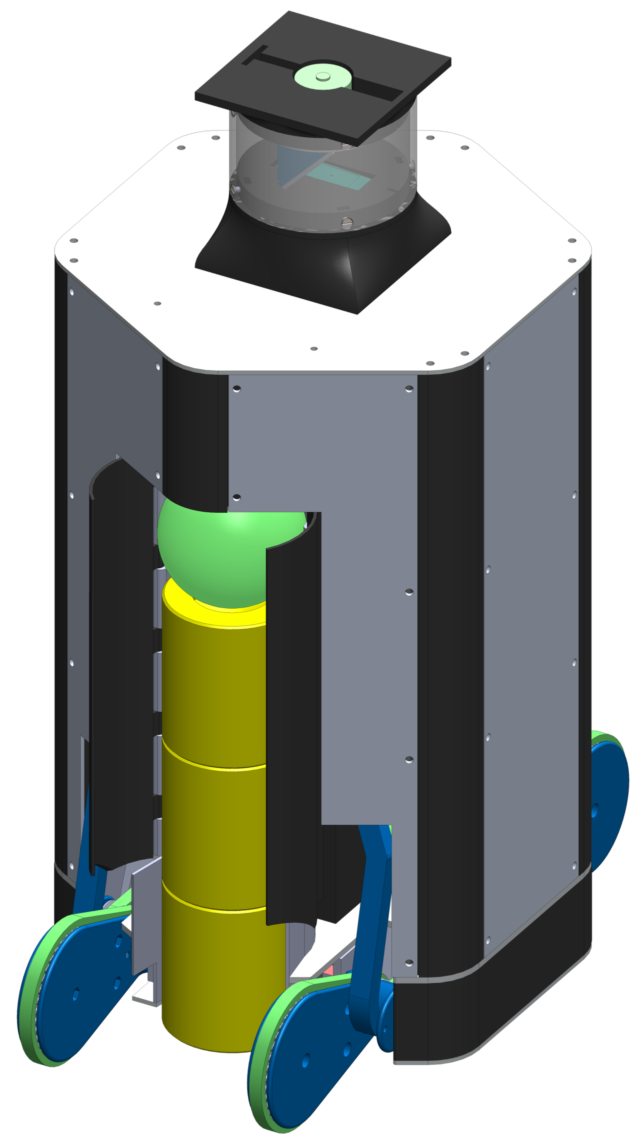
CVRA

Club Vaudois de Robotique Autonome

Debra & Caprica

Swiss team





Debra

Debra gathers cylindrical stands and stacks them to form spotlights with a ball on top. It does also close the clapperboards and it can move popcorn cups.

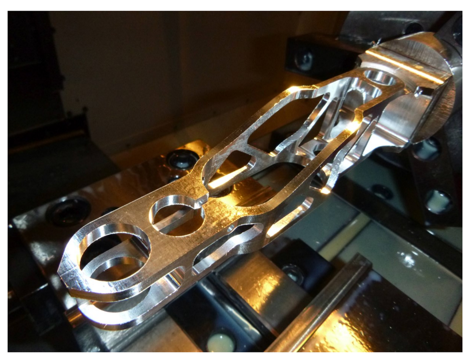
Caprica

Caprica gathers cylindrical stands and stacks them to form spotlights with a ball on top. It does also fill cups with popcorn, climb the stairs and deploy the red carpet.

Mechanical design

The concept of Debra was improved over the years and now features two 4-axis arms equipped with infinitely rotating hands which can grab up to 3 objects independantly.

The general build is comprised of a blend of of-the-shelf components and custom parts which are either machined or 3D-printed.
Some parts are made of 7075 grade of aluminium machined in a 4-axis mill.

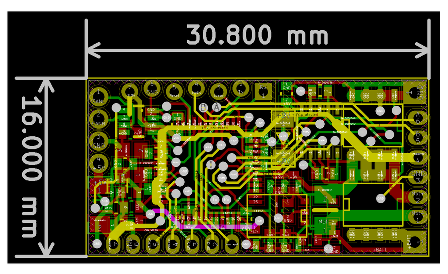


The platform is a common differential motion base, completed by a transverse holonomic motion detection wheel on Debra.

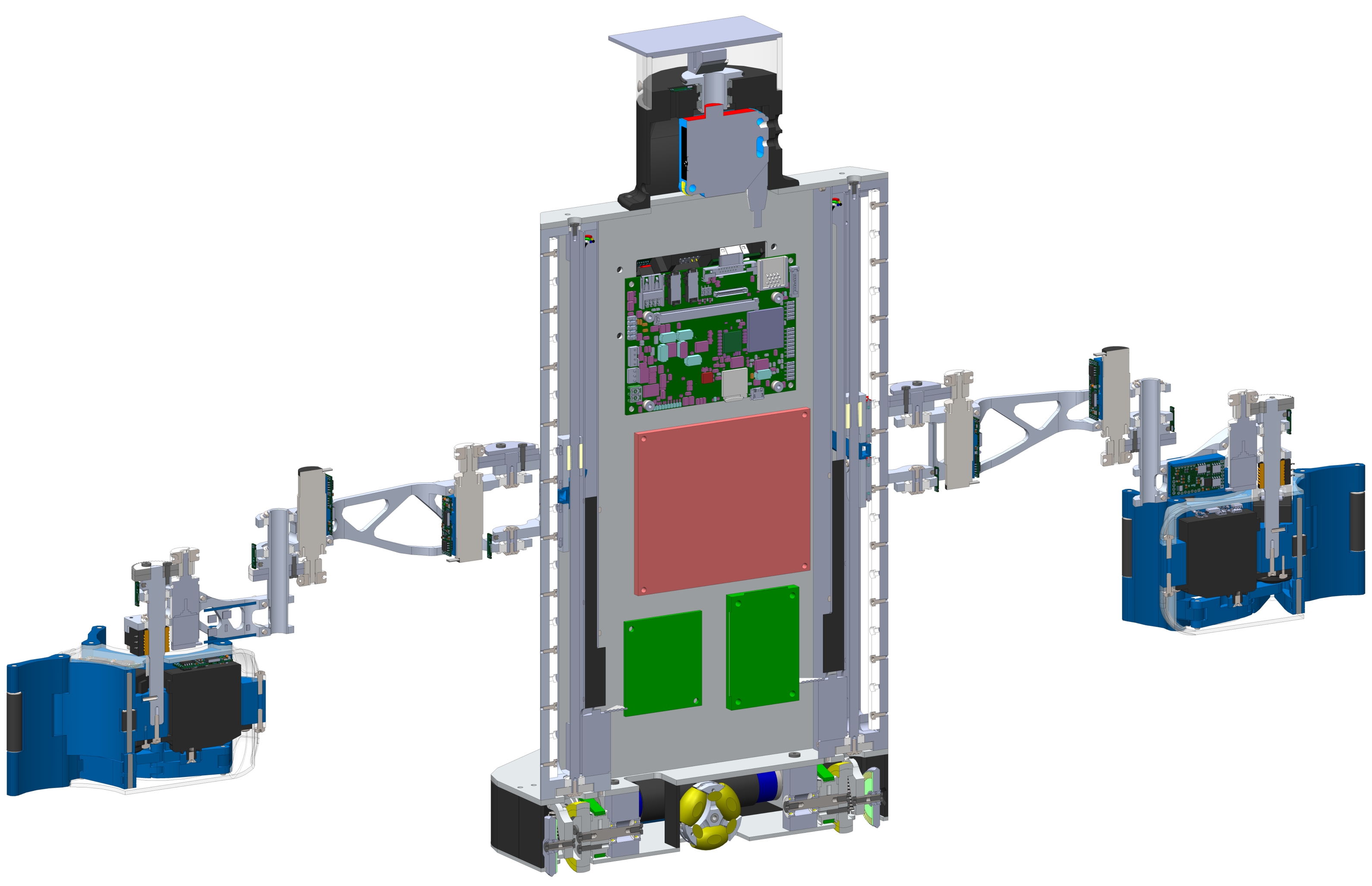
Deployable belts, an internal pipe maze and ducted fans are the distinctive elements of Caprica.

Electronics

The motor boards are interfaced on a CAN bus which is robust, has real-time guarantees, and has a relatively high data rate.



Servos are modified to embed our motor boards. These boards allow for a powerful control in torque, speed, position, and security.



Software architecture

Inside the body of the robots reside 3 computer platforms:

- a Toradex x86 PC (Linux, ROS)
- an ARM master board (ChibiOS)
- many ARM motor control boards (ChibiOS)

The master board controls all the motor boards through the CAN bus. The x86 PC is handling the planification and coordination of trajectories for the base and the arms. Globally, tasks handled by the software include motion planning, inverse kinematics, and time optimal trajectory generation for the arms.

On the PC, we use ROS as a framework for communication. It comes with advanced libraries for pose estimation, localization, mapping and navigation.

On top of the CAN bus we use UAVCAN as a higher level protocol to manage the flow of data between the motor boards and the master board.

The motor boards follow the received trajectory points via a triple cascaded PID-controller (torque, velocity, and position).

Beacons & sensors

Laser beacons are used to localise the robots of the adversary.

The LiDAR (Laser range finder) detects robots and game elements, mapping the table layout.

The team

Antoine Albertelli Software: testing	**Salah Eddine Missri** Software: ROS	**Guillaume Schaufelberger** Mechanical design: Caprica Playground
Rouven Althaus Electronics Sponsoring	**Boris Pillionnel** Mechanical design: Caprica Playground	**Jessica Schmid** Electronics
Romain Bersier Mechanical design: Debra	**Florian Reinhard** Software: controls	**Michael Spieler** Software: CAN communication
Pierluca Borsò Laser range finder	**Dominik Reukauf** Mechanical design: Caprica	**Patrick Spieler** Software: controls Electronics
Lorenz Leimgruber Beacons design & build	**Mathieu Rouvinez** Machining & production	**Pius von Däniken** Software: path planning

Our sponsors

Many thanks to our sponsors for their priceless contributions to our robots!

Pictures: **Videos:**

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