CVRA

Club Vaudois de Robotique Autonome

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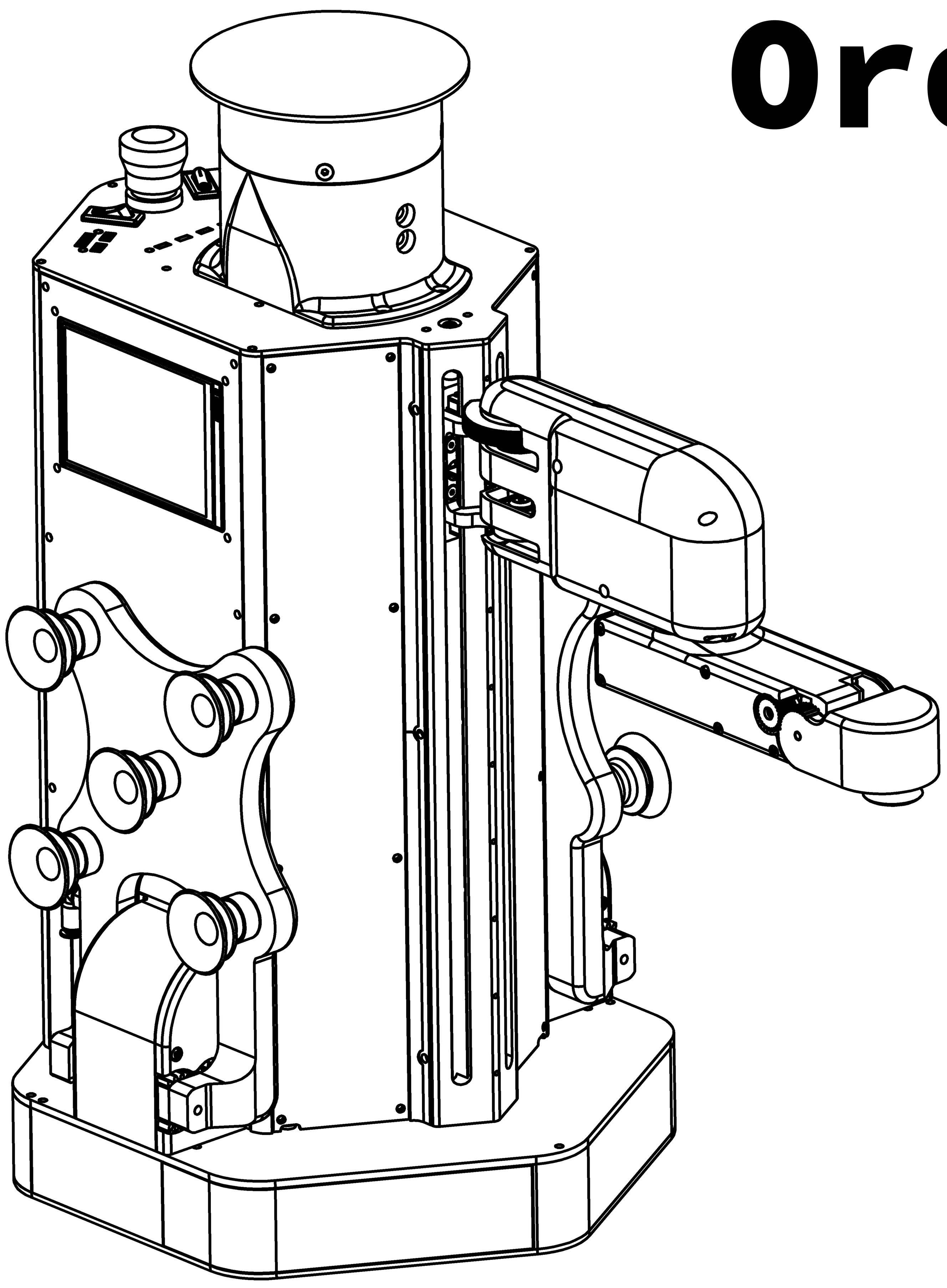
2018 team

Antoine Albertelli
Dorian Konrad
Florian Reinhard
Lucas Nicollier
Mathieu Rouvinez
Michael Spieler
Nicolas Péteut
Romain Bersier
Rouven Althaus
Salah Missri

Order & Chaos



The Debra Platform

The Debra Platform is our universal robot concept. It can adapt to changes in the game rules and objectives. This time around, it is constructed with one SCARA arm!

It features two lever arms on the side, allowing it to pick up 5 cubes simultaneously per side. The main arm has 1 linear axis and 2 rotational joints that allow the robot to build a tower of up to 4 cubes. Computer vision on fixed beacons informs the robot of the color sequence to build. An additional pitch axis at the end of the arm allows us to stack a 5th cube on top of the already awesome tower. The Debra Platform loves towers!

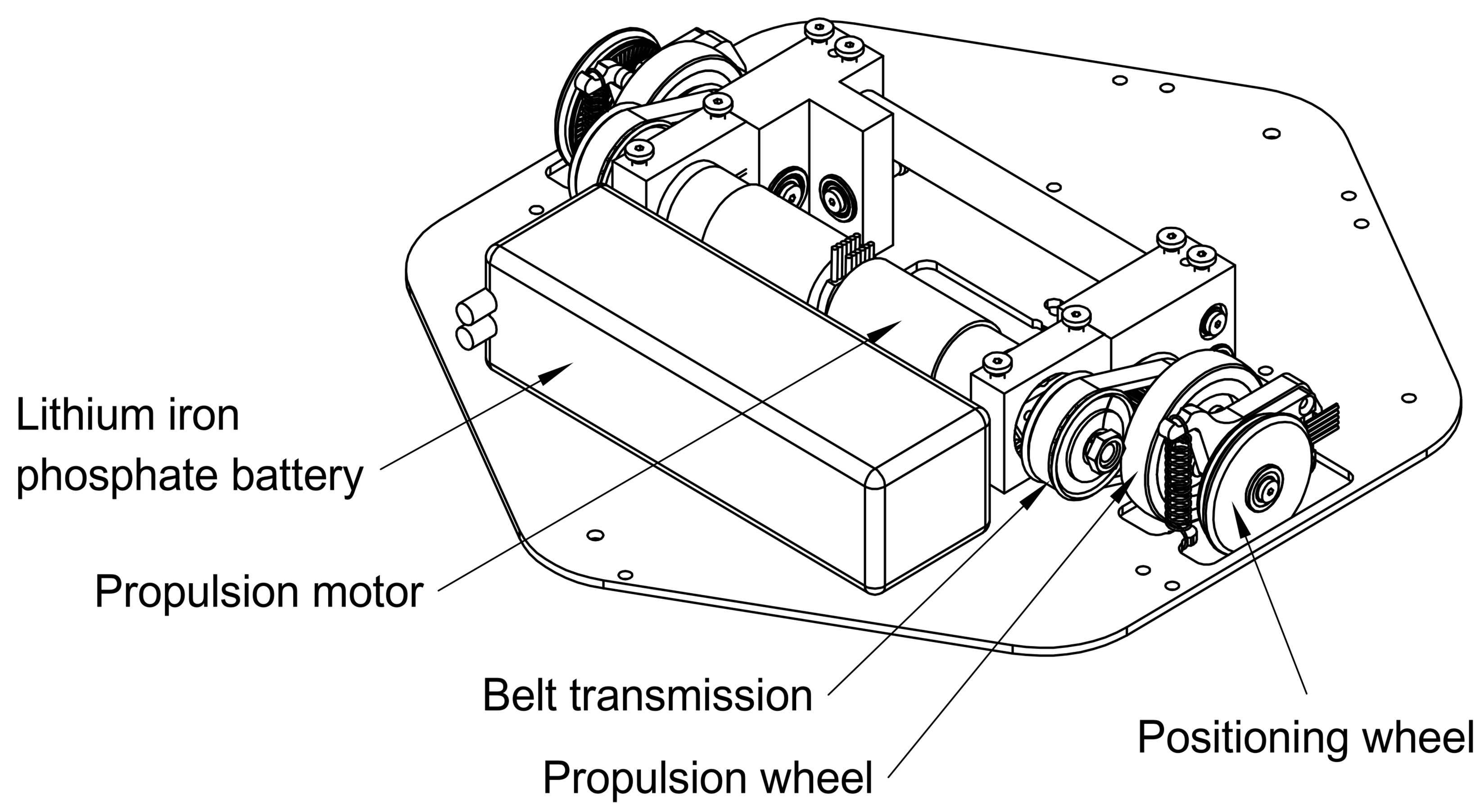
At the end of the arm there's a new board equipped with a ToF (Time of Flight) sensor and a color measurement sensor. This board provides the robot with feedback on the presence and color of cubes in order to think, elaborate a strategy and react accordingly.

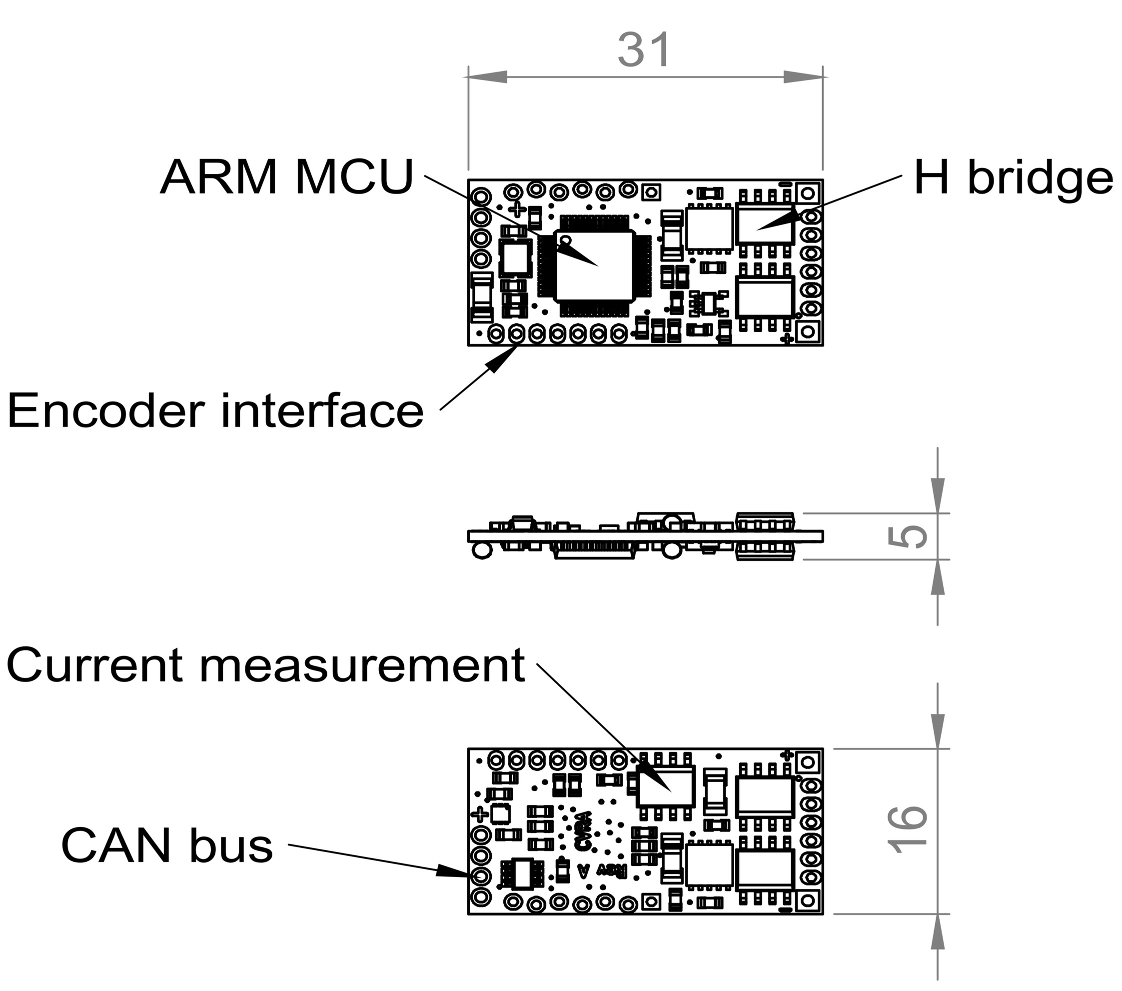
The Debra Platform detects opponents by using a beacon system based on light reflection. The beacon mast emits a beam of light, which is reflected by a circular catadiopter fitted on each opponent. By rotating the sensor, the Debra platform measures the apparent size of the reflector, which provides an approximation of the distance. This information is then fed to the motion planning algorithm.

Propulsion

Debra moves around using two wheels in a differential drive setup. Propulsion comes from two Faulhaber DC motors with gearboxes. A belt transmits the motion to the wheels. This architecture allows for great flexibility in motor placement and alignment.

Positioning of the robot is done using dead reckoning. For this we rely on two POSIC quadrature encoders, providing a resolution of 160 steps per millimeter. To avoid loss of precision due to slippage, these encoders are mounted on a separate set of wheels.





Electronics

Our robot is designed around a CAN bus using the UAVCAN protocol. This allows for easy wiring (sort of), great performance (sort of) and fantastic debugging experience (sort of). Each motor has its own board, controlling it in torque, velocity, and position. The size of those boards allows them to be fitted anywhere, including inside modified RC servos. Other functionalities are also exposed through CAN, such as the opponent detection system, a GPIO & PWM board, and a software update service (bootloader).

Everything is controlled by a master microcontroller, responsible for tasks such as dead reckoning, path planning, and strategy. This contrasts with previous years, where those tasks were carried by an embedded computer running Linux. The current architecture was chosen to simplify the programming workflow.