CVRA

Club Vaudois de Robotique Autonome

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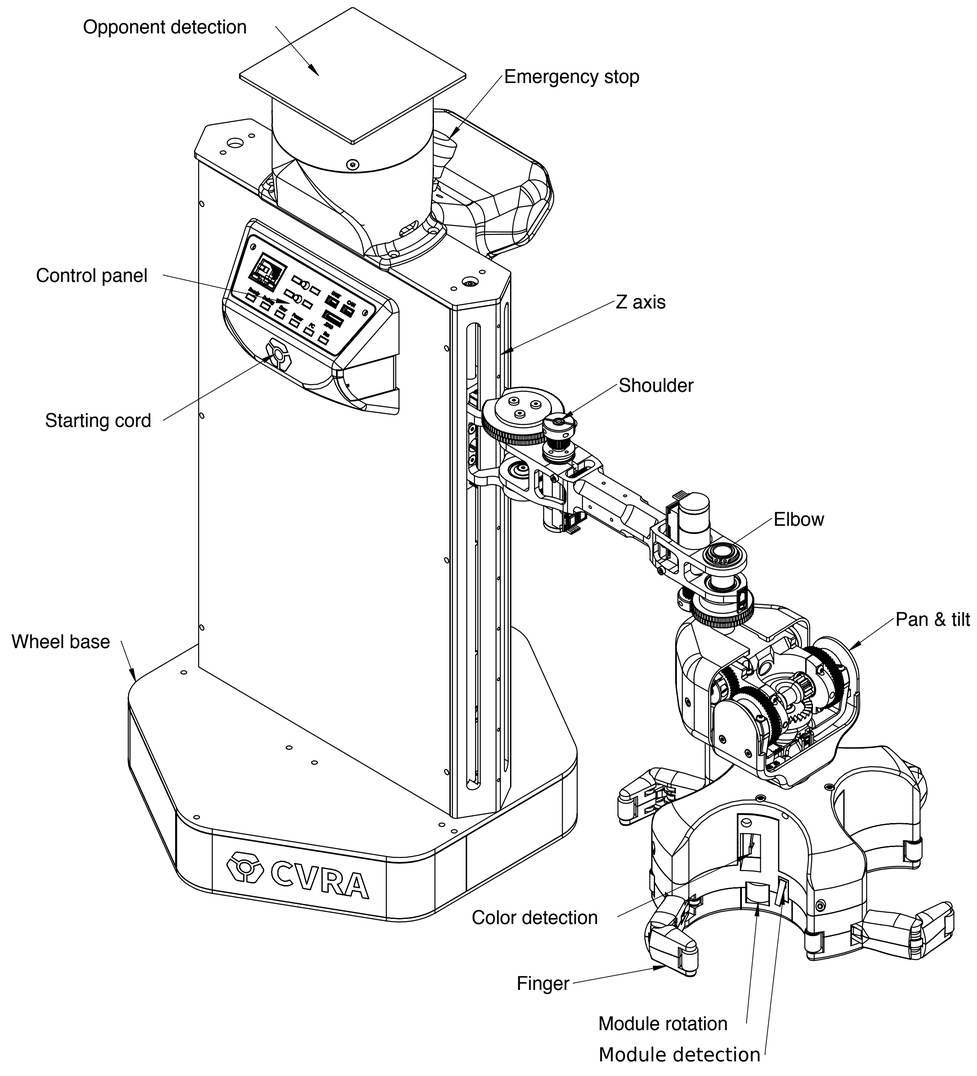


Debra

Debra is our universal robot concept. It can adapt to change in the game rules and objectives. It is constructed around two SCARA arms.

It features new hands with four independent fingers each, allowing it to pick up to four lunar modules at the same time (per hand). This year we also upgraded the arms by adding a 5th rotation axis, to lay out the modules in the construction areas. The 4th and 5th axis have the same center of rotation and use a differential drive to generate the pan and tilt motions.

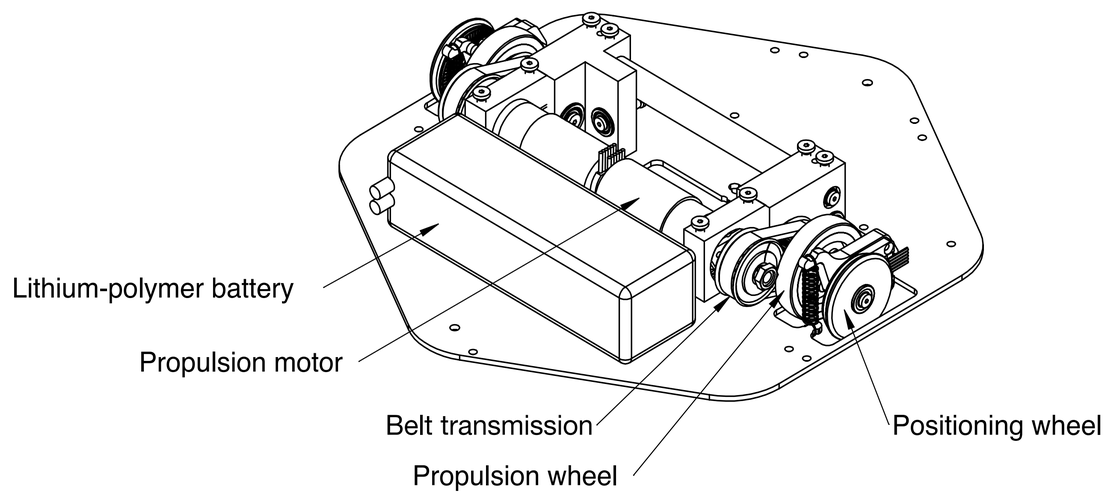
In addition to this, each hand contains one motor to orient the lunar modules on the correct side. One Sick color sensor per finger allows for detection of the module's current orientation. Finally, one switch detects if the object was correctly picked up.

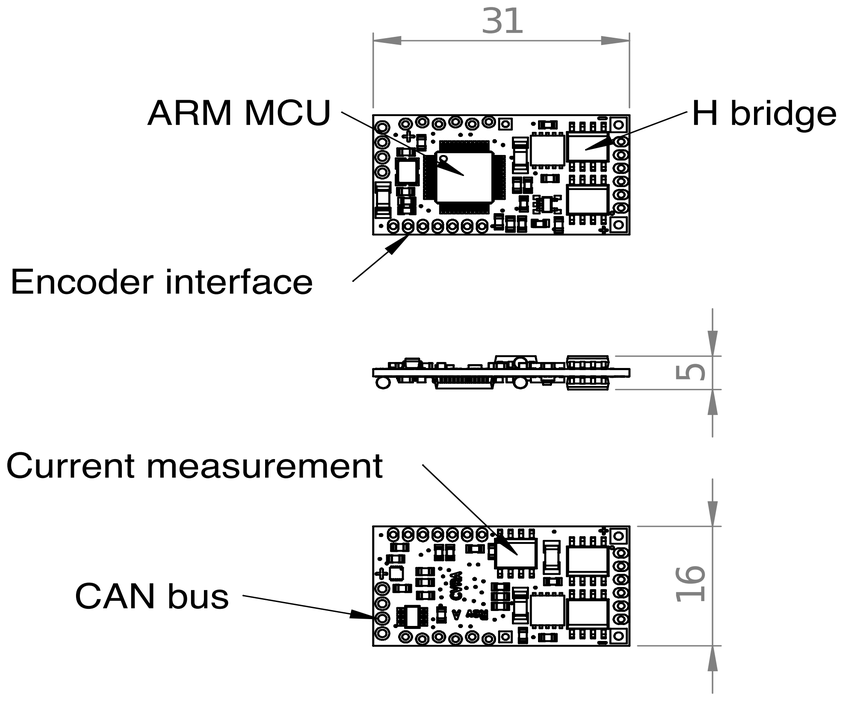
Debra detects its opponents using a beacon system based on light reflection. The beacon mast emits a beam of light, which is then reflected by a circular catadiopter fitted on each opponent. By rotating the sensor, Debra can measure the apparent size of the reflector, which gives us an approximation 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 then transmits it 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, giving us a resolution of 160 steps per millimeter. To avoid loss of precision due to slippage, those are mounted on separate set of wheels.





Electronics

Our robot is designed around a CAN bus using the UAVCAN protocol. This allows 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. We made this choice to simplify our programming workflow.

Many thanks to our sponsors who allow us to follow our passion

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