

Dual sensor integration, amelioration & production of a performant quadruped leg

Context:

The EPFL Xplore Research Pole has the objective of building a legged robot. The robot is designed to autonomously navigate through challenging terrain using its on-board sensors. Last semester, a second iteration of the leg was designed and prototyped, with good design for manufacturing guidelines in mind. As the system is still in the prototype stage, a final third revision is needed to reach a more mature design.

Project description:

The goal of this project is to refine this design, test and validate the integrated magnetic contact (ON-OFF) foot sensor and the motor commutation from a rotary RLS ORBIS absolute encoder. At the end of the semester, the leg will have to be manufactured and assembled with the final materials (no prototype). If time permits, testing and early characterisation of the leg will be performed.

Furthermore, the student will be an integral part of the Xplore Legged Robot Team, actively participating in its weekly meetings and working sessions. This collaboration will facilitate close interaction with other team members, and the student is expected to share their findings and progress with the team regularly.

Tasks roadmap:

- **Coding** – Implement firmware to read the analog foot contact data and the Orbis encoder RS422 data. Integrate this code into the existing Moteus code already running on the Amulet BLDC controller. Send everything through FD-CAN to a Raspberry Pi.
- **Testing** - Test the capabilities of the current leg. Identify flaws and potential improvements. A custom test bench and Python test files could be prepared for this purpose.
- **Mechanical Design** - Review and finalize current design. Integrate proper cable management. Protective and esthetic covers are a plus. Emphasis on a lightweight design is expected.
- **Prototyping** - 3D printing, metal laser cutting, machining of any parts that requires it.
- **Testing** - Test thoroughly your new design. Excellent results are expected before going to the next step.
- **Manufacturing** - Ask for quotations to manufacturers if needed, choose the best option, then order and produce the new leg.
- **Characterization** - Test all features of the new legs, their robustness, play, backlash, wear...

Requirements:

- Experience with CAD design, advanced Fusion360 skills are a solid plus.
- Experience with mechanical assemblies, tolerances and components like bearings, gears...
- Experience with prototyping, machining techniques & manufacturer capabilities.
- Knowledge of communication protocols such as SPI, I2C, CAN-FD, Serial RS422.
- Experience with STM32 firmware & motor control is a plus.

Contact:

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