Release the Robot From the Pendant

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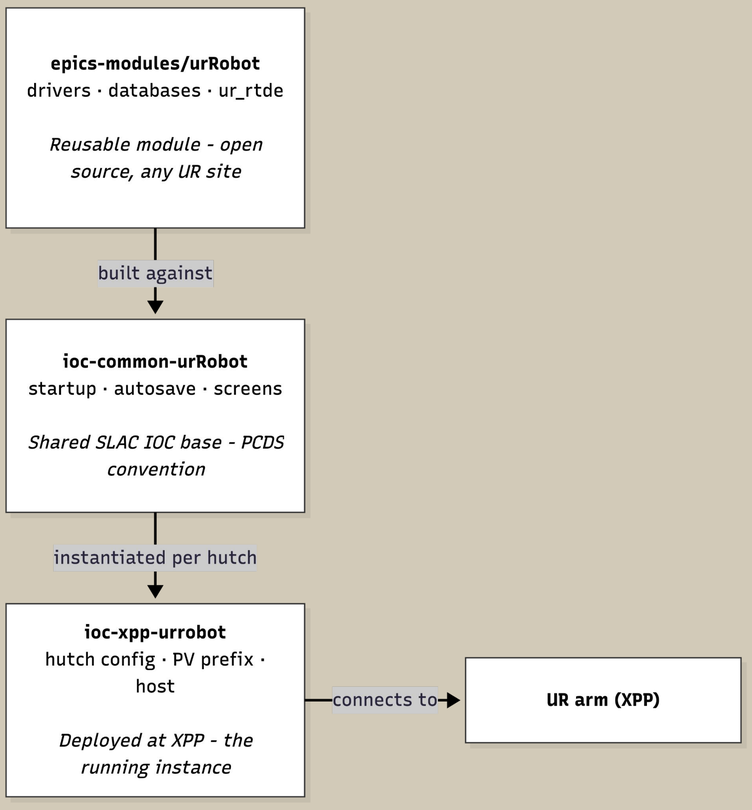
Background / Overview

A robotic arm is installed near the X-ray beam and will position a camera or sensor for monitoring samples during X-ray laser experiments. The arm is currently operated locally through a handheld pendant. This means the robot cannot be operated while the beam is active, limiting experimental flexibility and efficiency. This project integrates the robot into the existing control system, enabling remote motion control and monitoring while maintaining safe operation during active beam conditions.

Deployment

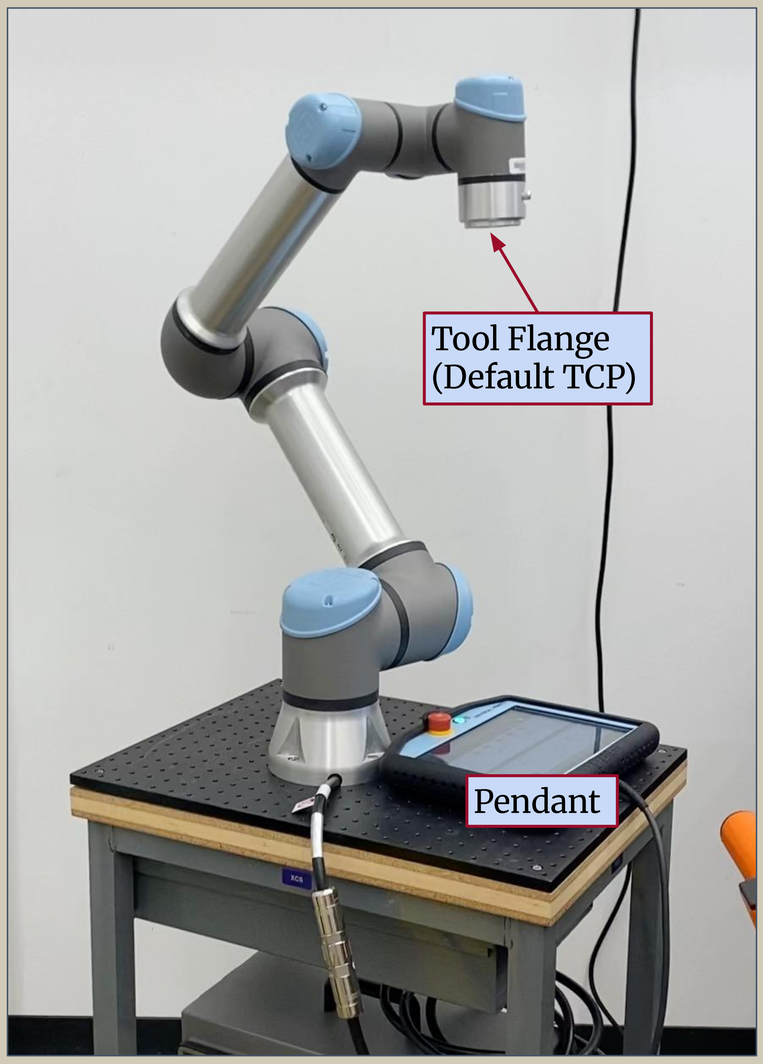
The xpp ioc instance is running on the xpp iocmanager. The ioc for the robot follows PCDS's standard three-layer convention as shown in the diagram below. This modular set-up keeps concerns cleanly separated and makes configuring new robot instances easier



How the integration happened

EPICS

A templated common IOC was configured for the specific urRobot arm instance, and a child IOC was deployed for the XPP instrument. The device was integrated into the XPP subnet to enable communication with the existing control infrastructure, and custom GUIs were developed for remote monitoring and control. Additional integration work included boot-safe Local/Remote state handling, automatic driver reconnection after communication loss, and synchronization logic to prevent stale robot-state data following network. interruptions. A cross-session buffering issue in the underlying ur_rtde library was also identified and corrected to ensure reliable command responses after reconnection.

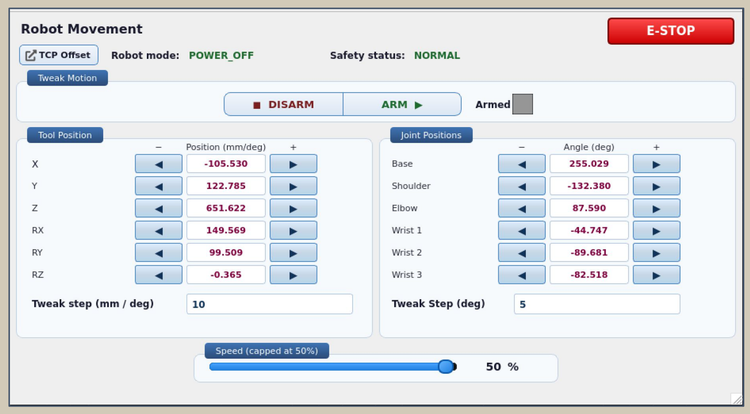


GUI Support

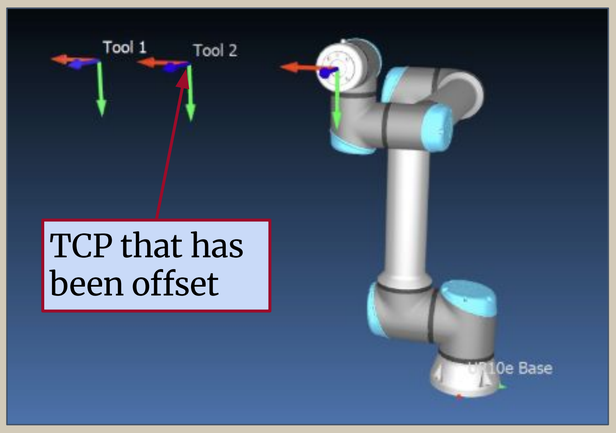
PyDM

The primary PyDM interface currently provides basic robot movement and TCP offset control. The remaining urRobot support screens were also converted to PyDM, creating a foundation for future GUI support such as waypoint programming, digital I/O control, and additional robot functions.

Basic movement GUI:



TCP Offset GUI:



Future work

- Waypoint functionality (this would help scientists with sample alignment)
- Soft-motor functionality (standardized EPICS motor control)
- More GUIs and a GUI dashboard to support more features

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REFERENCES

[1] N. Marks, "EPICS Support for Universal Robots," in Proc. ICALEPCS'25, Chicago, IL, USA, 2025, p. 684. doi:10.18429/JACoW-ICALEPCS2025-TUPD079.

GITHUB:

https://github.com/slac-epics/urRobot
https://github.com/pcdshub/ioc-common-urRobot
https://github.com/pcdshub/ioc-xpp-urrobot