NRI: INT: Customizing Semi-Autonomous Nursing Robots using Human Expertise

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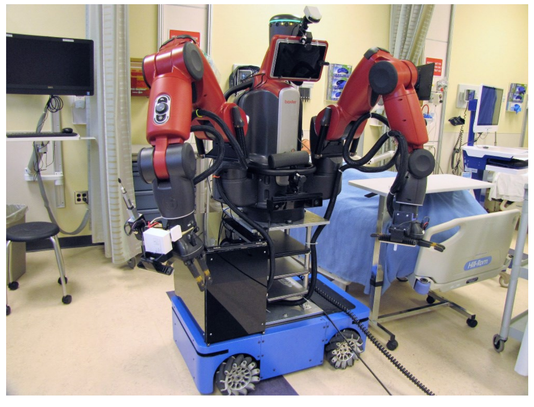
Summary

- Collaborative project between Duke engineering and nursing schools (began 9/1/2018)
- **Goal**: enable human domain experts to train a tele-nursing robot to operate semi-autonomously
- Develop capable mobile manipulator TRINA 2.0 and primitive manipulation / locomotion tasks
- *Teaching UI* to catalog objects, locations, compound tasks
- *Smart UI p*resents user with common tasks and parameters in spatial / procedural context
- Tested on nursing students (novices) with UI trained by RNs (experts)

TRINA 1.0

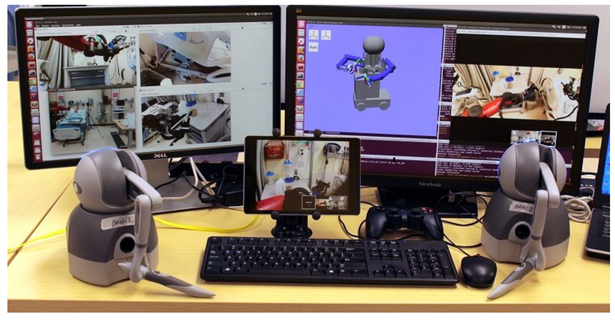
- TRINA 1.0 developed with NSF RAPID seed funding in response to Ebola crisis

TRINA 1.0 in nurse teaching lab



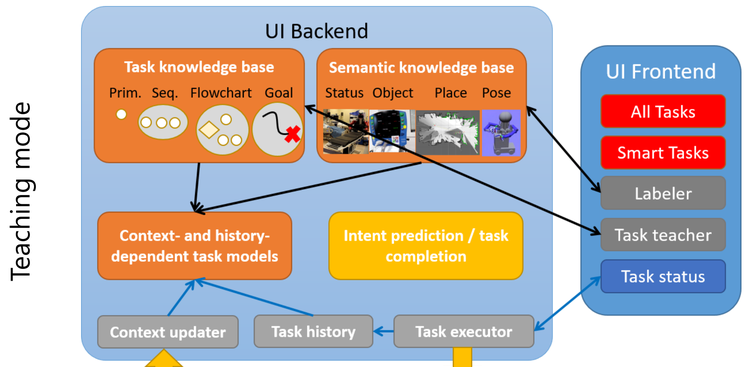
- Direct teleoperation solves ~65% of nursing tasks, but very slow (50x slower than human) [1]

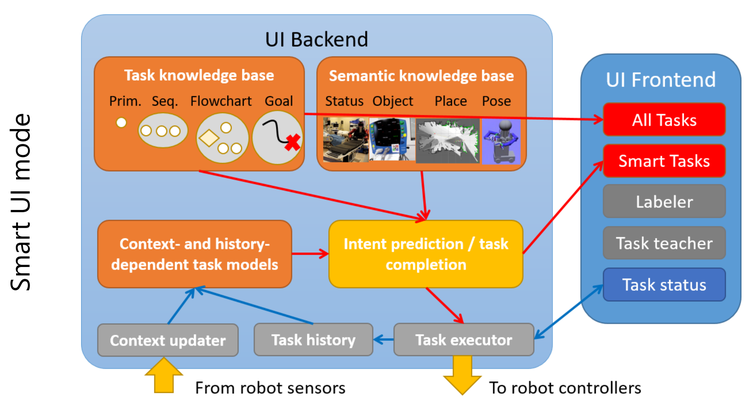
Operator's console



Smart UI framework

- Expert annotation of objects, places, poses, and compound tasks subsequently used in minimalist smart UI





Primitive tasks

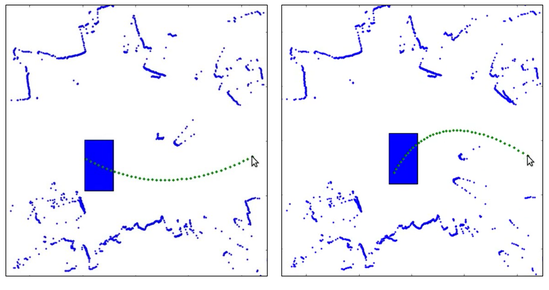
- Reliable nursing skills will be development in consultation with nurses, including:
- Navigation and body positioning
- Grasping, nonprehensile manipulation, compliant manipulation
- Instrument and tool operation

Current progress

Personal protective equipment design and self-doffing [2]

In-hand 3D object scanning [3]

Reactive collision free navigation



References

[1] Z. Li, P. Moran, C. Dong, R. Shaw, and K. Hauser. Development of a Tele-Nursing Mobile Manipulator for Remote Care-giving in Quarantine Areas. ICRA 2017.

[2] T. Lu, H. Bader, and K. Hauser. The Design and Doffing of Personal Protective Equipment for Healthcare Robots. MHSRS 2018.

[3] F. Wang and K. Hauser. In-hand Object Scanning via RGB-D Video Segmentation. In submission.