Program Verification and Synthesis for Collaborative Robots

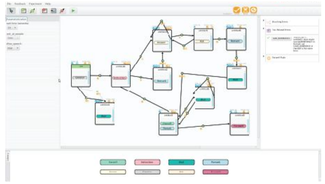
David Porfirio[1], Andrew Schoen[1], Laura Stegner[1], Emmanuel Senft[1], Maya Cakmak[2], Allison Sauppe[3], Aws Albarghouthi[1], Bilge Mutlu[1]
University of Wisconsin–Madison[1], University of Washington[2], University of Wisconsin–La Crosse[3]
https://peopleandrobots.wisc.edu/research/robot-programming-methods-tools/

The goal of this project is to investigate novel techniques for programming human-robot interactions by bridging concepts from robotics, human-robot interaction, and programming languages.

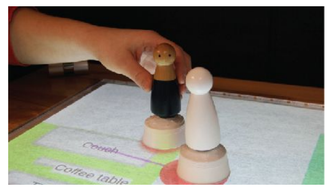
Authoring Social Robots

Challenge: Robots must adhere to social and behavioral conventions.

Solution: program verification, program repair, and program synthesis interfaces



Verification of Social Norms



Repair from End-User Feedback

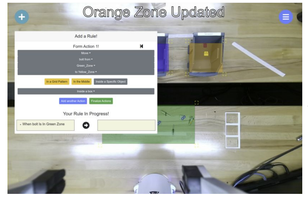
Synthesis from Tangible Demonstrations

Synthesis from Role-Playing Demonstrations

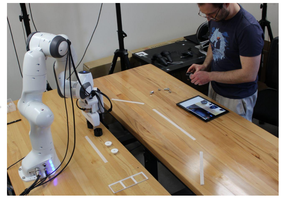
CoFrame / Cobot TAP

Challenge: Usage of robots by novice programmers in a way that support complex and safe collaborations with robots.

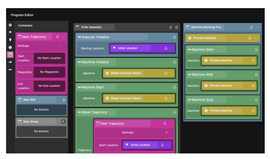
Solution: interfaces for rapid and simple programming and programming with feedback



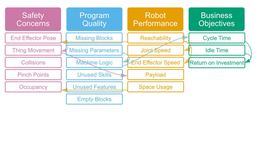
Programming robot behavior in situ



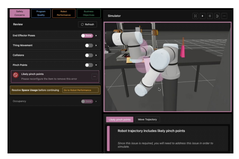
Solve the task with the robot



Created an instruction system for teaching novices to think like experts while creating a program



Translated a model of robot programming expertise into a set of feedback types.

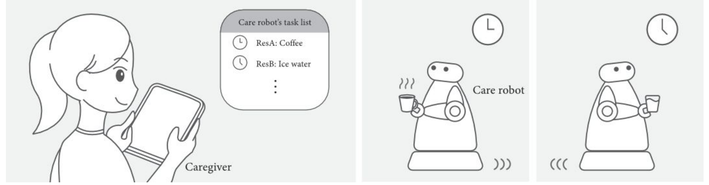


Program feedback identifies issues such as pinch points and provide visualizations while novice works.

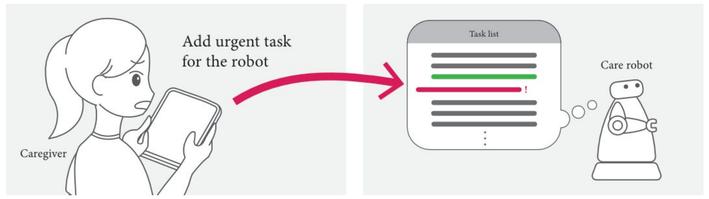
Care Robot Programming

Challenge: Allowing caregivers to program care robots to assist with day-to-day tasks and interact with individual residents.

Solution: design study to find opportunities for programming care robots



Scheduling tasks and customizing task details for each individual resident



Managing different levels of task prioritization based on urgency

Scientific Impact

Developing novel paradigms for programming using state-of-the-art computational methods

Broader Impact - Societal

Making robot programming accessible to the broader public and lowering barriers to engagement in technology development

Broader Impact - Outreach

Grandparents University, University of Wisconsin–Madison, *2019*

2022 NRI & FRR Principal Investigators' Meeting
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