



# Multiparty Human-Robot Interaction for Building Trust Through Physical and Verbal Actions

Ishaan Chandra - ishaanc3@gmail.com

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## Introduction

My lab partner, Riya Ranjan, and I worked in Professor Matarić's Interaction Lab under our Ph.D. student Christopher Birmingham to help research socially assistive robots. Chris focuses on multiparty human-robot interactions for building trust between humans.

More specifically, we worked on using the Nao – pictured in Figure 1 - robot in a middle school setting to help mediate conflicts such as bullying and academic stress.

We programmed different questions and gestures to make Nao more human-like in the interaction, which helps build more trust between the kids and robot.

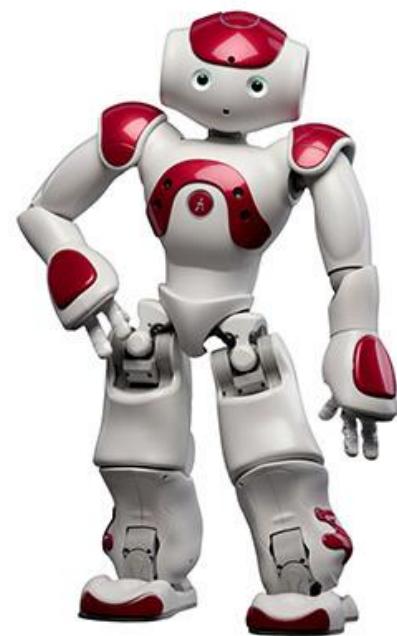


Figure 1. Nao. This is the humanoid robot that mediates the conflict. It can talk and move through its speakers and motors.

## Objective & Impact of Prof. Matarić's Research

Professor Matarić's research is aimed to give robots the ability to help people. Her goals are to gain novel insights into human behavior and cognition through human-machine interaction and developing robotic systems capable of providing personalized assistance individually or in teams.

Professor Matarić's Interaction Lab focuses on socially assistive robots capable of aiding people through social interaction rather than through physical contact.

## Project Details

We first researched common conflicts among middle school students and how the robot can help mediate those conflicts. The two most common problems among middle schoolers were bullying and academic stress.

We then planned an interactive setup with various questions, statements, and gestures for Nao to act out to mediate these conflicts. These questions are meant to facilitate a conversation between the children and help resolve the conflict in a way that is more effective than what a human could do.

- “What would you change to improve how you feel?” – This encourages the kids to share their own feelings and think of something to improve how they are feeling.
- “How can you relate to how the other person is feeling?” – This inspires the kid to be empathetic and take the perspective of the other kid to help ease the conflict.
- We coded multiple gestures: nodding its head to indicate that it is listening, waving, opening its hand(Fig 2) to indicate that it is talking to the group, dabbing(Fig 3), tracking the user's face(Fig 4), and many more.

Using Python, we coded Nao to speak out these dialogues and act out these gestures. The dialogue and gestures made Nao more human-like so the kids would be more trusting of the robot and are more likely to share.

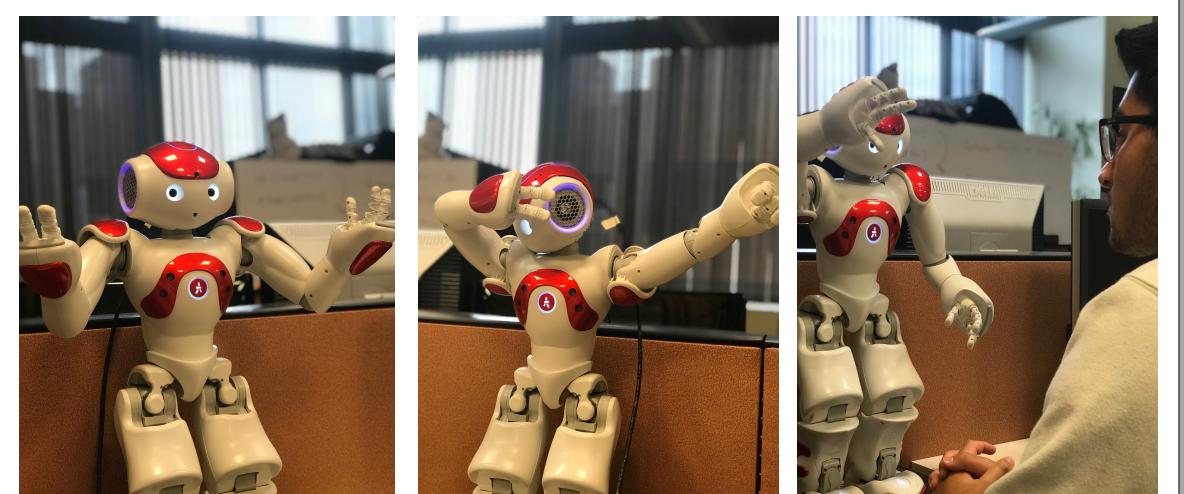


Figure 2. Nao opens its hands.

Figure 3. Nao dabs.

Figure 4. Nao waves and tracks the user.

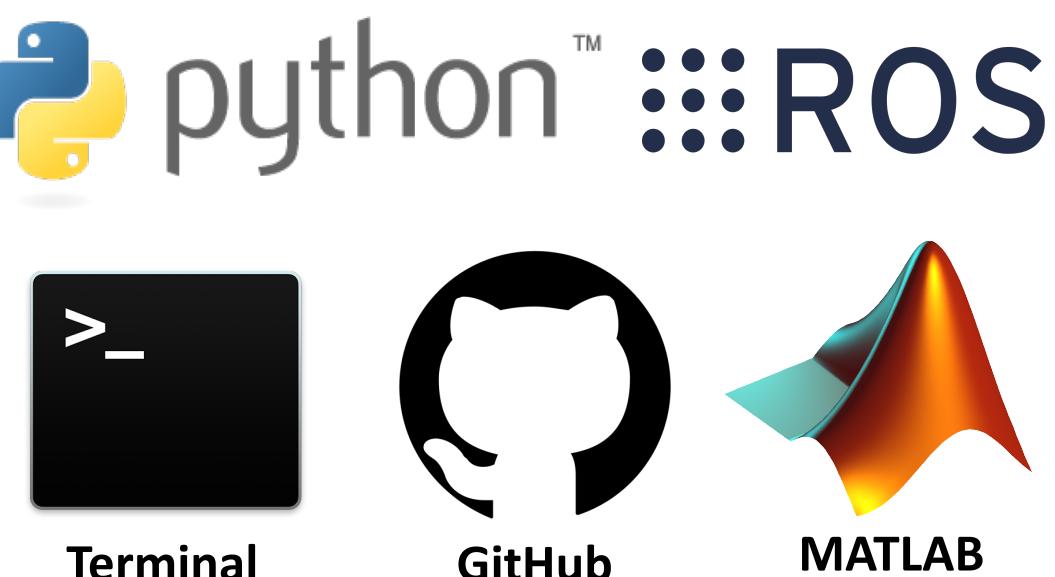
## Skills Learned

### Technical Skills:

- ✓ How to program in Python
- ✓ How to navigate and exploit the Terminal
- ✓ How to use GitHub and Git through Terminal
- ✓ How to use MATLAB
- ✓ How to read scholarly articles

### Other Skills:

- ✓ How to utilize online resources
- ✓ Self-learning and independence
- ✓ Patience
- ✓ Problem-solving
- ✓ World of research



## Relation to STEM Coursework

My SHINE experience primarily relates to my STEM coursework in computer science. I was able to use the logic and skills from my computer science courses to help me quickly learn Python, ROS, Terminal, GitHub, and MATLAB. Additionally, the skills I learned such as independent learning, finding scholarly articles, and researching can be translated into my STEM coursework. I will continue to use these skills in my last year of high school and college. The knowledge I gained will help me with future coursework and the various computer science related activities I am involved in such as hackathons and robotics club.

## Next Steps

I plan on majoring in computer science in college. After, I might want to acquire a Master's degree in computer science. I will use the skills I gained here at SHINE to continue expanding my knowledge in computer science and applying it in my coursework and computer science related projects. With the skills to self-learn a programming language, I want to continue exploring Python and learn other languages to continue creating programs in real-world scenarios.

## Advice for Future SHINE Students

My advice would be to make the most out of your time here at SHINE. Even though seven weeks may seem like a long time, it passes by quicker than most people think. Do not be afraid of asking your Ph.D. mentor questions and for help. They are here to help and make your experience better. Don't be afraid to communicate with your Ph.D. mentors. Talk to the other SHINE students and make friends. Almost everybody is really passionate and interested in what they are doing. Each lab is doing really cool and innovative things so learn about them! Take advantage of the resources SHINE gives you such as the workshops and lectures by various professors in different fields.

## Acknowledgements

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