The Use of Animations to Make Socially Assistive Robots More Interactive with Humans

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Introduction

Socially Assistive Robotics is a relatively new field that combines elements of psychology and computer science to develop robots that assist humans through social means [1]. I worked with my PhD mentor Tom Groechel to increase the amount of "direct", safe interactions possible between a human and a robot using mixed reality. My project basically builds upon the project my mentor Tom did which was creating the virtual arms of Kuri [2]. My role in this was creating new animations for those virtual arms like creating a high five between the robot and the human. allowing students to safely and directly interact with Kuri.

Objective & Impact of Dr. Matarić's Research

Dr. Matarić's research focuses on utilizing socially assistive robots to benefit humans' lives, especially those in need. For example, one aspect of the research deals with using the robots to help autistic children. Another aspect of the research deals with assisting kids through educational means by developing robot tutors. Socially assistive robots have the ability to impact humans in a wide variety of fields apart from mentally and educationally. They can be used to provide comfort and support for the elderly and bring about a new perspective on robots: one that is not harmful.

Fig. 1 PC: Tom Groechel
Keyframe of Kuri Arms clapping

https://robotics.usc.edu/publications/media/uploads/pubs/pubdb_1047_26d66912461d4
8749d0c9550777df28e.pdf

Skills Learned

Technical Skills:
- Navigate the terminal
- Use Unity
- Utilize Animation Principles
- Use Github
- Work with MATLAB
- Use text editors like Visual Studio Code
- Use LaTex

Research Skills:
- How to write an annotated bibliography
- How to read and analyze research papers

Apart from these valuable skills, I learned a lot about the life of a PhD student and what doing research in a STEM field looks like. I learned how to come up with a research question, what a day looks like for a PhD student, the importance of research papers, etc. Through learning more about research, I can now see research as a viable path for my future.
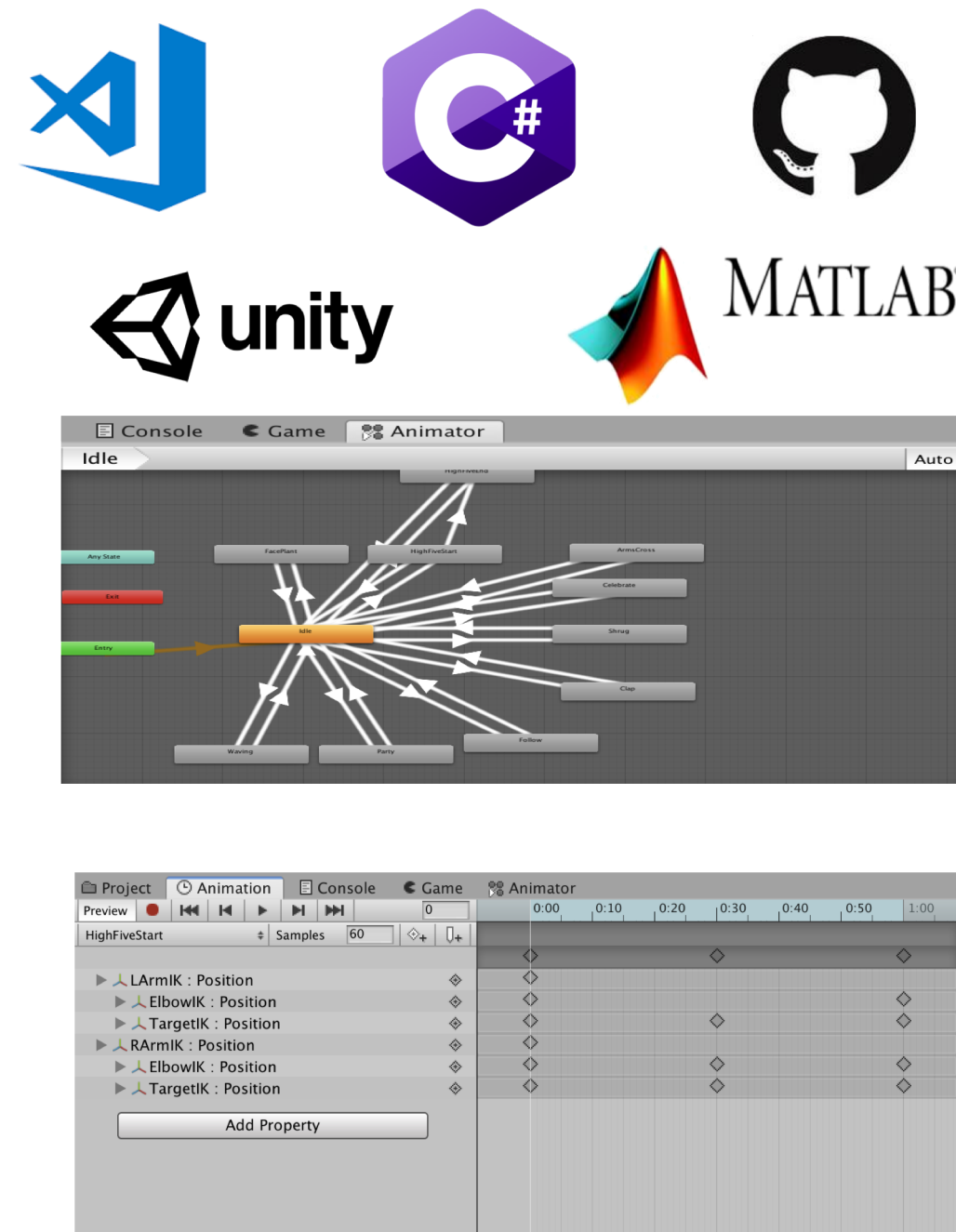

Fig. 2 PC: Annika Modi
Unity Animator and Keyframes

Methods

First, I created the animations for the virtual arms of Kuri in Unity. To get a better understanding on the arms and how to integrate animations to increase robot-human interactions, I read research publications [3]. The animations I created were all made to be interactive with the student who Kuri was helping in order to increase robot-human interaction and to ensure the student would feel more comfortable with Kuri. In order to create smooth animations, I used Disney's animation principles. To make the animations interactive with humans, I created a program that would play the correct animation when the Kuri arm would come in contact with the student's hand. I did this by using some of Unity's built-in components like the animator, collider, and rigidbodies.

How This Relates to My STEM Coursework

Here you will talk about the impact of your SHINE experience on understanding your STEM Coursework. You can also write about what you can bring back to your school to help them understand the significance of said STEM Coursework.

You may use pictures and figures

In my work, I was able to use concepts from:

- AP Computer Science A
- Online programming courses
- Physics
- Statistics

And I can apply these ideas:

- Through STEM clubs and activities
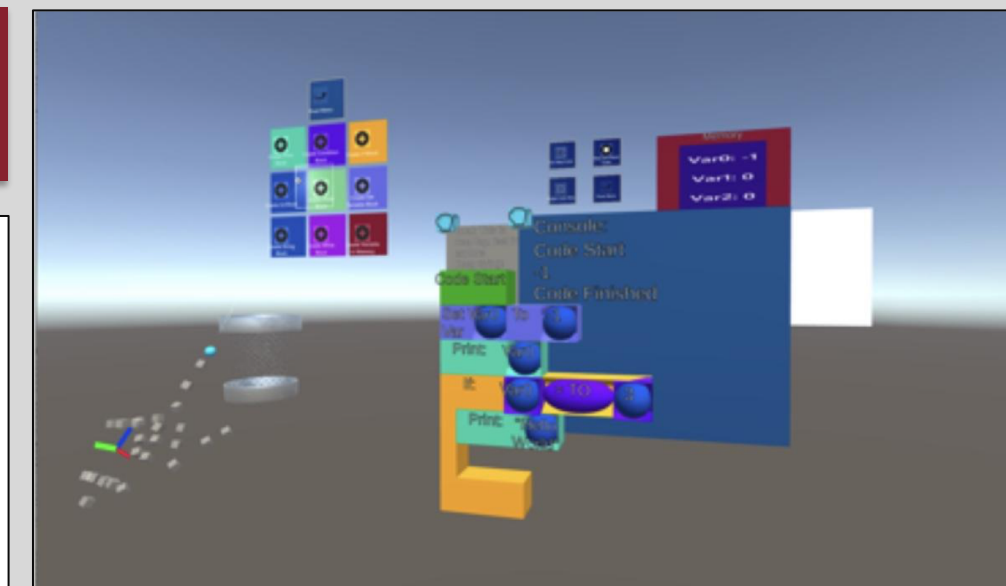- In future computer science courses
- In future physics courses

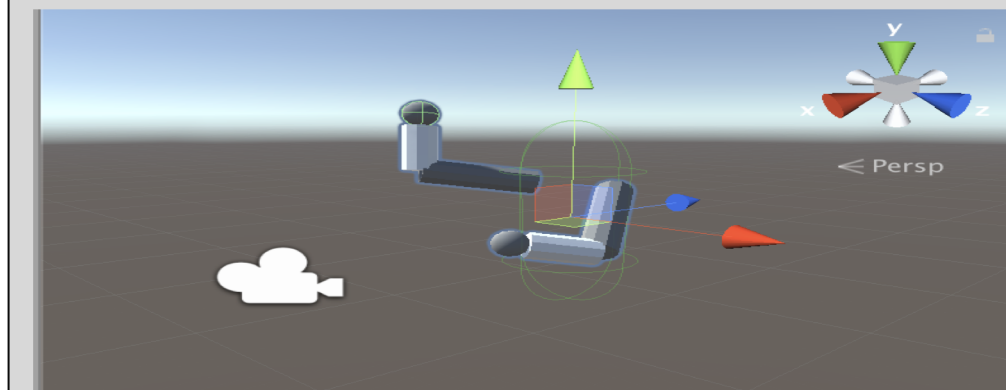Fig. 3 MoveToCode project PC: Annika Modi

Fig. 4 High five animation PC: Annika Modi

My Next Steps and Citations

I hope to attend a 4 year university as a computer science major. Through SHINE, I have found interest in research and will hopefully do undergraduate research with a focus on the interdisciplinary aspects of computer science.

[1] Feil-Seifer, D., & Mataric, M. J. (2005, June). Defining socially assistive robotics. In *9th International Conference on Rehabilitation Robotics, 2005. ICORR 2005.* (pp. 465-468). IEEE.

[2] Groechel, T., Shi, Z., Pakkar, R., & Matarić, M. J. (2019, October). Using Socially Expressive Mixed Reality Arms for Enhancing Low-Expressivity Robots. In *2019 28th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)* (pp. 1-8). IEEE.

[3] Saldien, J., Vanderborght, B., Goris, K., Van Damme, M., & Lefeber, D. (2014). A motion system for social and animated robots. *International Journal of Advanced Robotic Systems*, 11(5), 72.

Acknowledgements