Interaction With Collaborative Robots via Virtual Reality

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Project Introduction

Collaborative Robots (CoBots) are receiving attention from corporations due to it's elite feature to safely interact with workers, while performing technical tasks. Unfortunately, CoBots lack an effective design for cooperating with humans in a mutual workspace. Virtual simulations are utilized to represent the kinematics and dynamics of Baxter in a virtual immersive environment in which a human will be able to interact with the virtual CoBot.

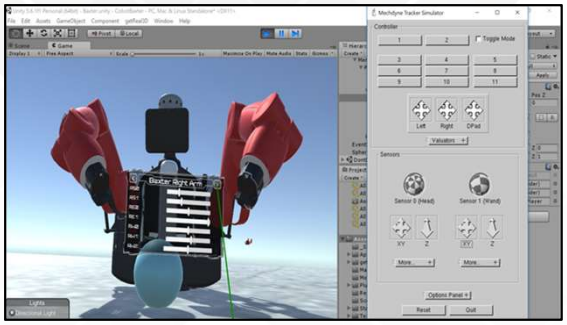
Relation Sustainable Mg.

Rave Cave (360 3D VR simulator) allows demonstration of the function of the products and has the capability to switch out and replace parts instantly, saving time, capital cost, resources and maintenance of dedicated training CoBot. Overall, CoBots are much cheaper, faster, safer, and more flexible than the common industrial robots.

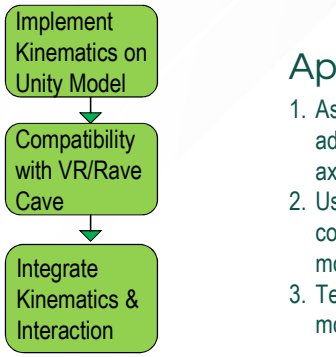
State of Knowledge

WSU has developed a CAD Model for Baxter and transferred it to Unity, but has yet to code the kinematics into the model. This project proceeds with the kinematics and virtual reality components for the interaction of a human with a virtual CoBot in an immersive environment (Rave Cave). Knowledge on Unity and Mechdyne getReal3D is essential to this research.

Seven Rotational Joints of Baxter

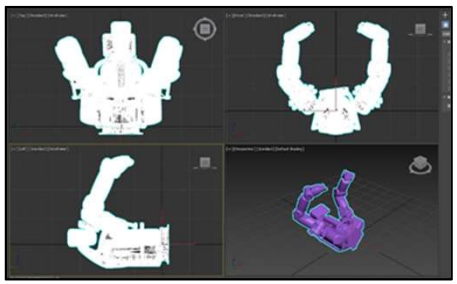


Baxter Model in Unity with UI Sliders in VR Menu and Tracker Simulator

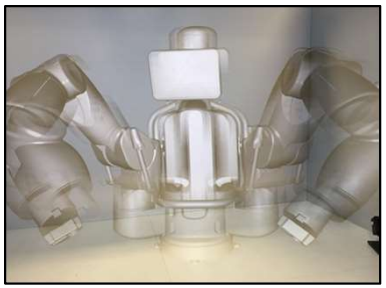


Approach

1. Assign individual parts to corresponding joints, adjust axis to desired axis, code rotation of each axis
2. Using Mechdyne getReal3D plug-in for VR compatibility, enable VR features and modify model
3. Test interaction between character and Baxter model in VR world to optimize interaction



CAD Model of Baxter



3D Baxter Model in Rave Cave

Results

A Tracker Simulator is provided through Mechdyne getReal3D and operates as a user interface permitting the movement of the user's body, head, and hand/wand through Unity. The wand has three colors, each representing a different function. The green wand for pointing, the blue wand enables grabbing and maneuver of objects, and the red wand acts as a solid object and results in collision. This also includes a number pad which results in a specific action when pressed. The wand is able to grab and maneuver the end-effector of Baxter's arms, causing the joints to adjust according to the movements.

Conclusions

This research project will prove to be more cost effective and secure. It invokes kinematics for accurate movements in Rave Cave. This has been successful with the implementation of kinematics and VR capabilities. The establishment of a 360 virtual environment will ease the integration of CoBots into manufacturing systems. This research will expand in the future with adjustment to increase accuracy of kinematics. For instance, the joints must be adapted to rotate with the touch/force of the user's control wand and/or sensor gloves. With the completion of this research, users will be able to safely cooperate with CoBots in a mutual workspace.

About Me

I am currently an undergraduate sophomore student from New City, New York pursuing a dual degree in Computer Science and Computer Engineering at New York University.

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References

1.Djuric, A., Urbanic, R., and Rickli, J., "A Framework for Collaborative Robot (CoBot) Integration in Advanced Manufacturing Systems," SAE Int. J. Mater. Manf. 9(2):2016, doi:10.4271/2016-01-0337.