

Robots have a great impact on how many things get done on a daily basis. There are robots that make the circuit boards for our everyday electronics and robots that will vacuum our houses so that we don't need to. The size and functionality of robots vary greatly based on what they need to accomplish, but they all have one thing in common. Each and every robot needs to be controlled so they they can move in a predictable manner and perform their intended actions. Robotic arms are one type of robot where a good controller is very important. A good controller enables the robot arm to do precisely what was intended to do. While it seems like an easy task for humans to move their arm into any configuration that our skeleton allows, doing the same with a robot arm is rather complex.

This research will start with porting an existing controller for the Barret Whole Arm Manipulator (WAM) from USC to the WAM that we have in our lab. The WAM is a robotic arm that is similar to a human arm in size and range of motion. Our system also includes the Barret Hand which is a three-fingered robotic hand. Porting the controller consists of getting the correct hardware and installing the correct software so that a computer can communicate with the WAM. Porting the controller also includes writing documentation on how to install and use the system.

We currently have a controller for our WAM using Matlab, but it may not be the best controller for us to use. After porting the USC controller I need to compare the performance of the two controllers. Some of the things we need to find out are which controller is easiest to use; which controller moves the arm most accurately; which controller can be best integrated with our motion tracking and database systems. The answers to these questions will help determine which controller is best to use going forward. A good controller will make future research with the WAM much easier and more productive.

After determining the best controller, it is important develop features that will be useful in future research. One such feature is automatic calibration for the kinematic and dynamic models of the arm. When the arm picks up an object, its dynamic model changes because there is now more mass at the end of the arm. This will change the torque that needs to be applied to each joint in order to move the arm properly. It is also important that the controller is aware of the size of the grasped object so that it can avoid bumping the object into something like the table. Since each WAM arm has slight variations in the necessary forces to move it, automatic calibration can also make it much easier to move a controller onto a different arm.

This research involves porting a WAM controller from USC to our arm and comparing it to the controller that we have currently. Knowing which controller is better to use will enable us to perform research experiments with the arm with greater ease. Being able to integrate the controller with our motion capture and database systems will allow for many research in the areas of data mining and machine learning. None of which is possible without being able to move the arm accurately.