# 3D Print Prosthetic Arm

## Abstract

This project aims to produce a low-cost prosthetic arm customized for children. Instead of carrying high-tech equipments, it uses the lowest cost to complete daily events.

Considering the acceptance rate and physical characteristics of children, the controlling methods and materials are specified.

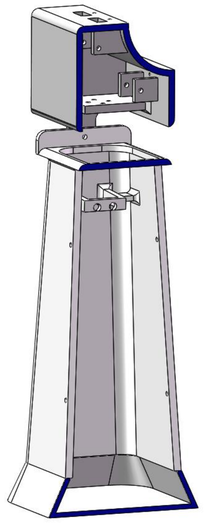
Using simplified model and 3D printing technology, the cost is greatly reduced, so that normal families are able to afford it.

## Background

There are many advanced prosthetic arm in the society now. They are produced with hard materials and sometimes beautiful decorations, and they have a lot of useful functions. However, their prices are too expensive and most of them do not work well on children.

For example, the speech-controlled and mind-controlled prosthetic arms are really convenience for adults, but children don't have the ability to learn and be familiar with them quickly. The popular sEMG prosthetic arm will be very unstable due to children's fatigue.

Thus, a new prosthetic arm is needed to fulfill the two requirements. It has to be at low cost in order to spread to everyone in need. It also need a simple and stable way to control.



## Model

This figure shows the model of the main part of the arm. The extra base is modeled so that the arm can stay on the table for exhibition.

The upper hand part and lower arm part is connected with a servo to rotate the hand.

Three holes are on hand for the installation of fingers. The fingers then can cover the object in the purlicue.

The circuit is in the arm. Two extra components are installed to fix the linear actuators. The platform on the top of the arm part stablizes the hand part and make the whole arm more beautiful.

## Result

The figure left is the result.

As we can see, the hand can remain stable even if it swings to the back. A switch that control the whole circuit is set on the outer shell. The max gripping ability is 482g, which can fulfill most requirements in the daily lives of children. When the fingers close entirely, the outermost knuckles of the two long fingers and the thumb are designed to collide together to hold small objects.

A black sensor is installed on the purlicue. This ensures that the automation function can work successfully.

Thus, we can conclude that the basic goals of the prosthetic arm have been achieved. The low-cost 3D printed prosthetic arm for children use is developed.

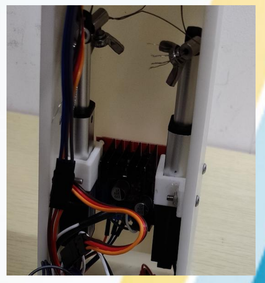
## Methods

There are two controlling methods programed in the prosthetic arm.

The first one is Bluetooth control. In a website called App Inventor, I made am app that has a Bluetooth server to connect with the arm. Users can simply click the buttons to control the hand, which is pretty straightforward.

When frequent usage of prosthetic arm is needed, the other automation function becomes useful. Once this function is activated, the fingers will automatically close to grip if a front sensor detects objects in side the hand.

The fingers tighten when the linear actuators installed inside the arm pull strings conneced to them back.



## Future Research

Firstly, we can add extra functions on it. In addition to the two control methods now, we can create a speech-controlling method.

There can be decorations on the surface to make the appearance better. What's more, a beautiful appearance can increase children's acceptance rate.

On the surface of fingers, a layer of materials with greater friction constant can be used in order to increase the maximum grabbing ability.

The twist structure can be improved by adding one more servo or using axis structure. This way, the hand can rotate freely to more angles.