



Enabling Engineering

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Project Agreement: Robotic Arm

Summer 2024

Description of Need to be Addressed

The patients have the cognitive ability of one year old and it makes tasks like lifting and pouring extremely challenging. The client is looking for a machine that will allow the patients to engage in recreational activities such as cooking. The patients will interact with the arm by pressing a button/switch that will start the machine. The machine needs to be able to turn from the baseboard and rise at least 1 foot high. The arm will need to extend at least 10 inches out and connect to the object that will be poured. The arm will be black with red highlights for easy visibility. Will need at least two modes for cooking: pouring and mixing. The arm should be able to attach easily to various vessels.

Previous Attempts to Address Need

Past attempts have been made for area scanning and did not take into account picking and placing items. Commercially most robotic arms are very expensive and are hard to control. There have been several previous projects that successfully pour liquids but require additional caretaker assistance, which makes the user less independent.

- <https://www.rehabmart.com/product/pouring-cups-kitchen-gadget-32487.html>

There are a couple of one-switch devices such as this pouring device for adaptive cooking, but cannot carry the same amount of load that is required for this project. This design with a flat board is very popular for adaptive cooking devices but the client specifically requested a robotic arm so we will be using a SCARA robotic arm based model instead.

- https://enablingdevices.com/product/pouring-cups/?attribute_pa_style=flex-mount&utm_source=google&utm_medium=cpc&utm_campaign=everything_else_pmax&utm_term=&gad_source=1&gclid=Cj0KCQjwhb60BhCIARIsABGGtw9d26lo5TfMF1qAyno6kqlvMOv12M4JjJUEwWLo6p4bglHVtv8ZkHUaAv2IEALw_wcB
- <https://www.fanucamerica.com/products/robots/series/scara>

Overview of Project

The arm will be able to pivot at the base, extend vertically up to 1 ft, and pour the cup at the end of the arm. It will be activated by a switch that the user will activate and the arm will attach to a cup and pour the ingredient into the bowl. The arm will have a wooden board as a base that the patient can easily reach from their wheelchair and the switch will be on that board. The arm will raise so that the patient will be eye level with the object that they are pouring. For a mixing mode, one idea is to attach a whisk to the end of the machine and move it back and forth to simulate mixing ingredients in a bowl. Another possibility is a display that allows the patient and caregiver to know which mode the machine is in. The machine will remain stationary and will require specific setup beforehand; there will be designated spots for the cups and bowls to sit. Over the span of 8 weeks, the project is limited by cost and trial designs. For us, during this shorter timeframe, this means that there will be a limit on the parts we can order. We will leave around 2 weeks to test the design and improve before we present it to the client. The client had requested a 'universal arm' but due to time restrictions, we have decided that it isn't realistic to create a universal end to the arm. Instead, we will try to meet the client's request by incorporating the two different modes. However, due to the 8 week restriction, we will focus our efforts on creating the pouring mode before the mixing so at the minimum they can complete a cooking class with activities like pouring flour and water.

Objective of the Project

- Create a robotic arm to:
 - Pour ingredients or other materials i.e. paint
 - Mix ingredients in a bowl
- Control the arm by:
 - Pressing a button to initiate action
 - Use a button to switch modes
 - Have a button override
 - View modes on a display (or other method)
- Create documentation:
 - Instructables
 - assembly & creation instructions
 - User Manual
 - GitHub Code Repo

Potential Constraints with the Project

- Cost cap of 200 dollars for final product
- Amount of time allocated
- Space on tray
- Ability of the user to control it

Project RoadMap/Deliverables

1. Project Name

1.1 Project Management

1.1.1 Project plan

1.1.2 Requirement collection

1.1.3 Reporting

1.1.4 Wiring Diagram

1.1.4 Assembly Instructions

1.2 Version 1

1.2.1 Finalized v1 CAD for 3D Printed Parts

1.2.2 Assemble without electronics

1.2.3 Assemble with electronics

1.3 Version 2

1.3.1 Update CAD

1.3.2 Assemble with electronics

1.4 Testing

1.4.1 Program Motion

1.4.2 Find maximum wight

Potential Timeline

Week	Deliverables
Week 1	Brainstorming, meeting with client to clarify intention of project
Week 2	Start designing
Week 3	Finish CAD design, begin 3D printing and building V1
Week 4	Finish building and assembly, testing with and without electronics (motors, arduino)
Week 5	Meet and review with client with completed prototype, design and edit for V2
Week 6	Start manufacturing V2, testing
Week 7	Assemble v2, testing

Week 8	Documentation
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Milestones

Milestones	Dates
<ol style="list-style-type: none"> 1. Have a completed project plan 2. Decide on a Finalized design 	18 July
<ol style="list-style-type: none"> 1. Resources should be ready 2. Start build phase 	25 July
<ol style="list-style-type: none"> 1. Have a semi-working prototype 2. Start writeups 	15 Aug
<ol style="list-style-type: none"> 1. Complete test phase 	25 Aug
<ol style="list-style-type: none"> 1. Presentation day 	30 Aug