Microwave Transfer Device

GNG2101 -Group A20

Introduction and Customer Needs

Our client suffers from limited mobility. They require a device that:

- Lifts an object from counter into microwave
- Is secure, reliable and easy to use
- Can handle different geometries (cups, plates, etc.)
- Is light enough to be transported by hand
- Can be operated simply and without much effort
- Alerts user when object is safe to remove from device

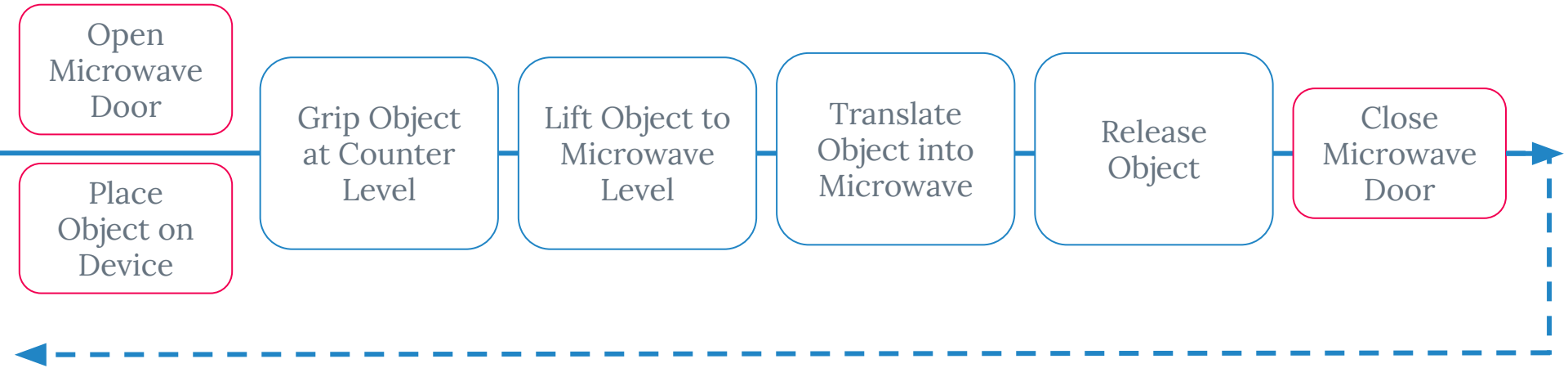
Problem Statement

Our client requires a device that can lift objects from their counter into a microwave safely and securely. The device can lift a wide variety of objects without any inconveniencing the user and has built in safety mechanisms to prevent the dropping of an object.

Design Specifications

Specification	Units	Ideal Value	Marginal Values
Vertical Lift Distance	in	>34	34
Object Weight	lbs	>5	3
Budget	$	>80	>100
Maximum Object Dimensions	in^2	12 x 12	11 x 11
Maximum Lift Time	s	<10	<30
Maximum Base Dimensions	in^2	?	?
Device Weight	lbs	<20	<30

Functional Decomposition



Reverse Process to Retrieve Object

Benchmarking

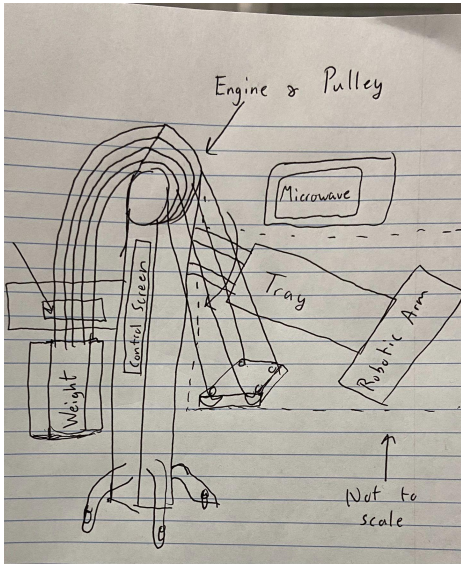
Very little on the market designed specifically for microwave transfer

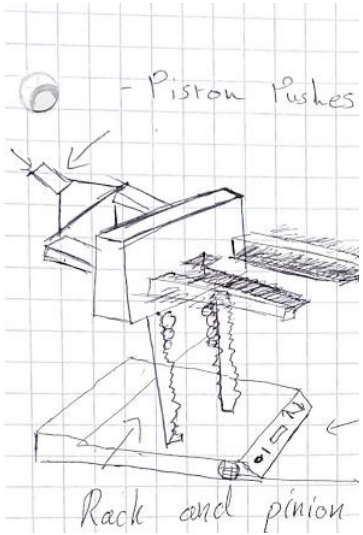
We looked at different types of object lifting and transport devices

Concept Generation

Each team member generated ideas for:

- Vertical Lift
- Horizontal Transfer
- Dish Gripper
- Control Scheme

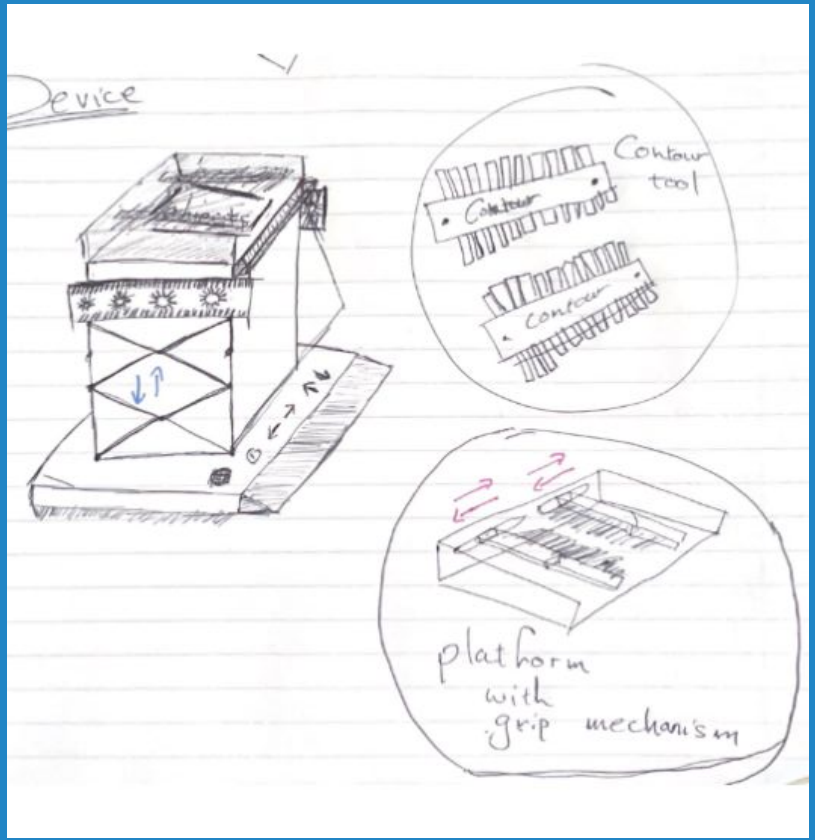




Global Concept

The team's overall design as of Deliverable C

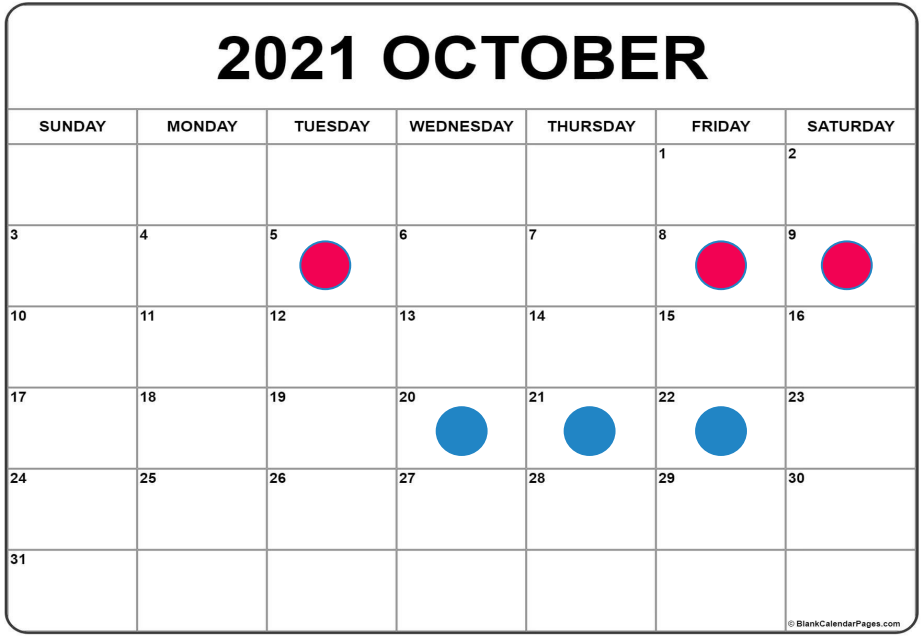
- Vertical Lift: Scissor
- Horizontal Motion: Rack and Pinion
- Gripper: Jaw Mechanism
- Controller: Arduino



Client Feedback

Client meeting 2 has been rescheduled multiple times

We have been relying on email communication

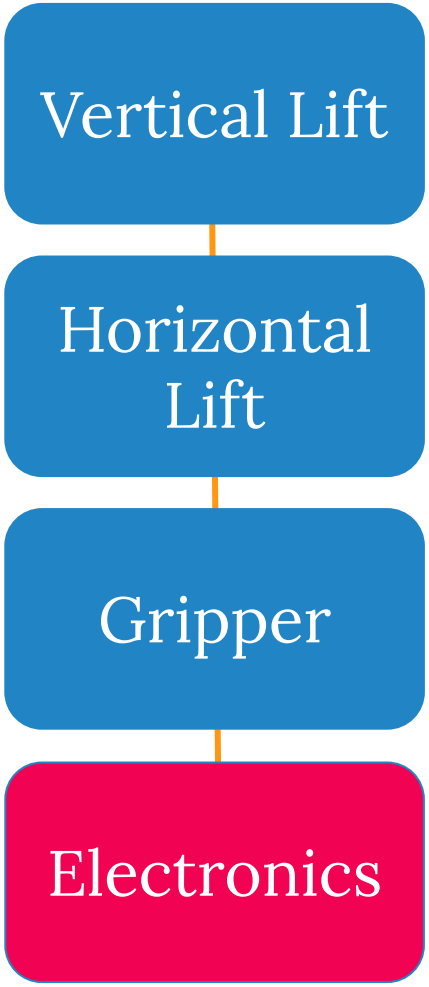


Prototype 1

Primary Goal: Generate detailed cost estimates for electrical components and the 3 mechanical subsystems

This will be done with:

- CAD Models
- Analytical Prototypes
- Researching Part and Material Costs



Electrical Components

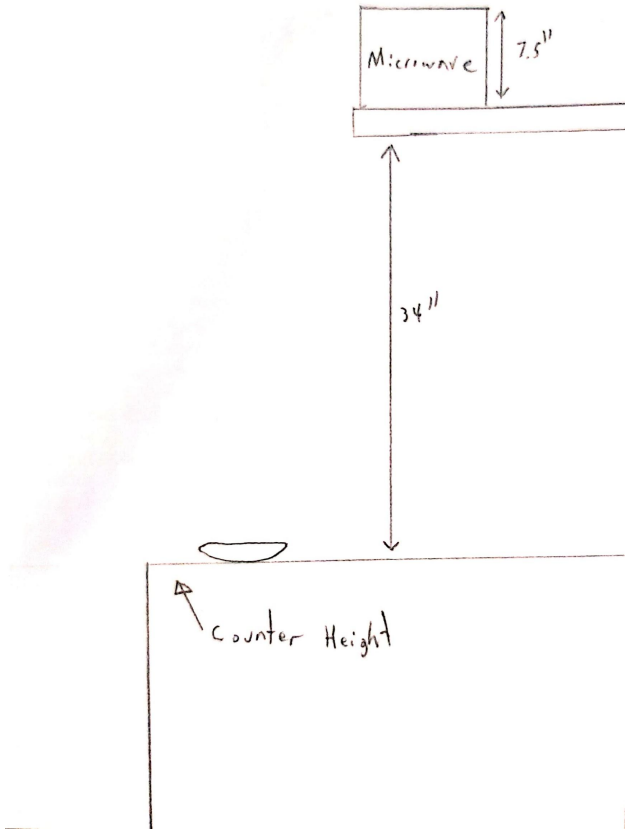
- Breadboard
- Cables
- Power Supply
- Buttons/Remote
- Arduino

$42.70 → Remaining Budget: $57.30

Vertical Lift

Specifications and Requirements

- Distance: 34”
- Estimated Load: 15* lbs
- Maximum Lift Time: 30s
- Must Allow Microwave Door to Open
- Be Stable Enough to not Spill Liquids



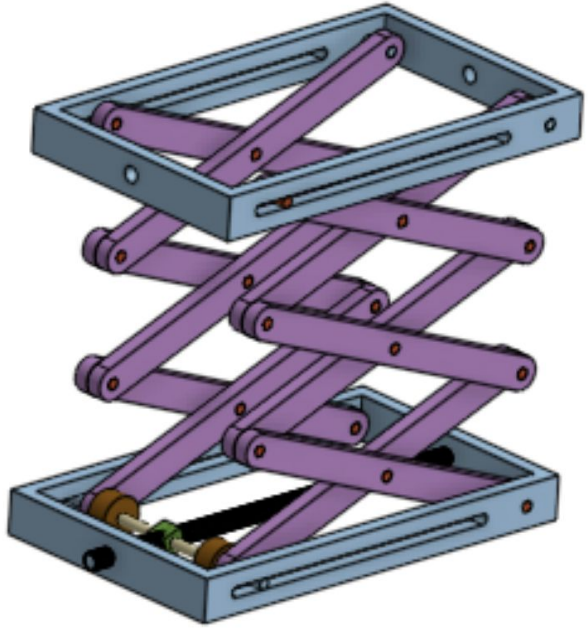
Vertical Lift Concept: Scissor Lift

Pros:

- Allows for microwave door to open
- Stable Platform
- Compact for transportation

Cons:

- Mechanical disadvantage
- Amount of machining/3D printing

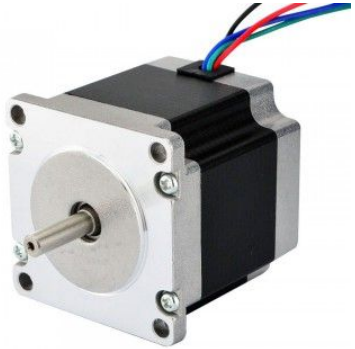


Vertical Lift Calculations and BOM

Needs to Push: 46.3* lbs

Required Torque: 147.0* oz.in

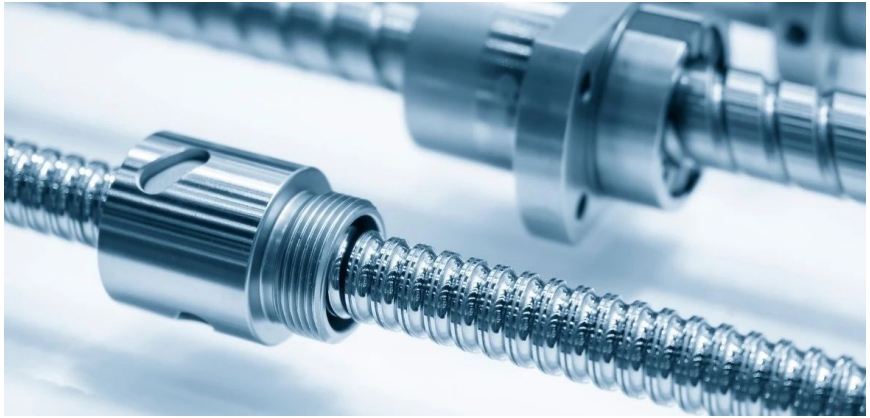
Motor Size: Nema 17 - Nema 23 Stepper Motor



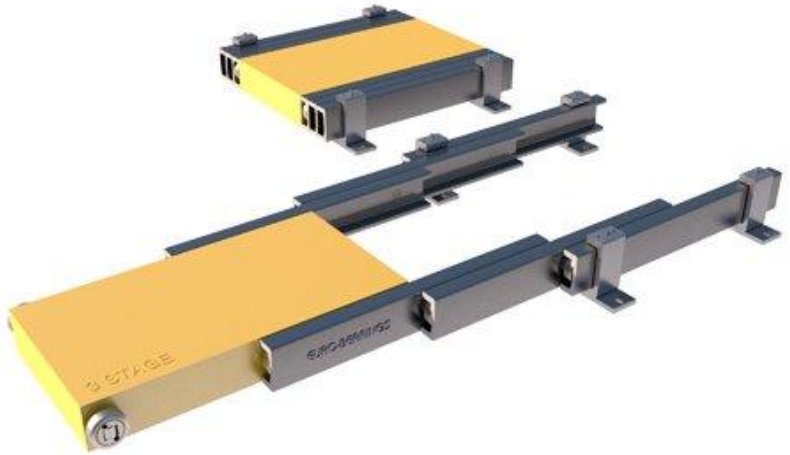
Part	Price
DC Motor	$15-25
Lead Screw	$5-10
Nuts	$5
Coupler	$10
Building Material	TBD
Sum	Min $35 Max $50+

Horizontal Device

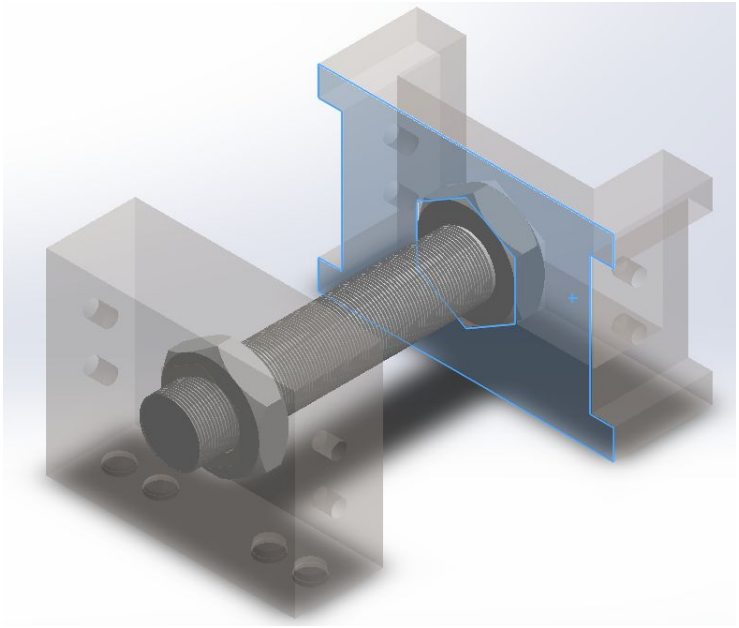
- Rack and Pinion
- Threaded Bar

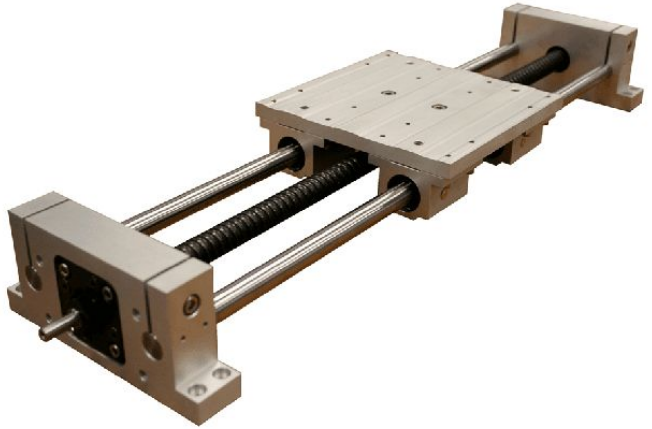


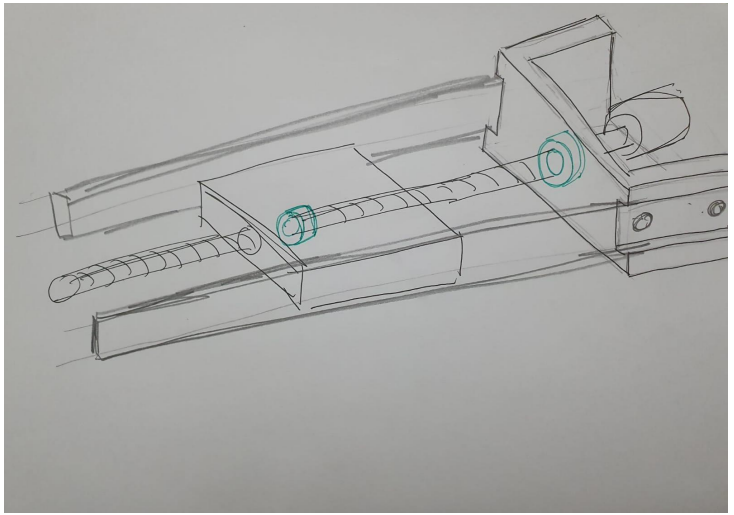
- Microwave Door
- Telescopic Guide



Horizontal Device Concept & Prototype







Horizontal Device BOM

#	Material/Existing Part	Quantity	Total Cost
1	Sheet Metal Screws	x2	$2.6
2	DC Motor	x1	$15
3	Threaded Steel Rod (Zinc Plated)	x1	$5.5
4	Hex Nut (Zinc Plated)	x2	$2
5	Metallic Telescopic Gate (Zinc Plated)	x2	$13.5
6	Stainless Steel Bar (20 Inches)	x1	$10.06

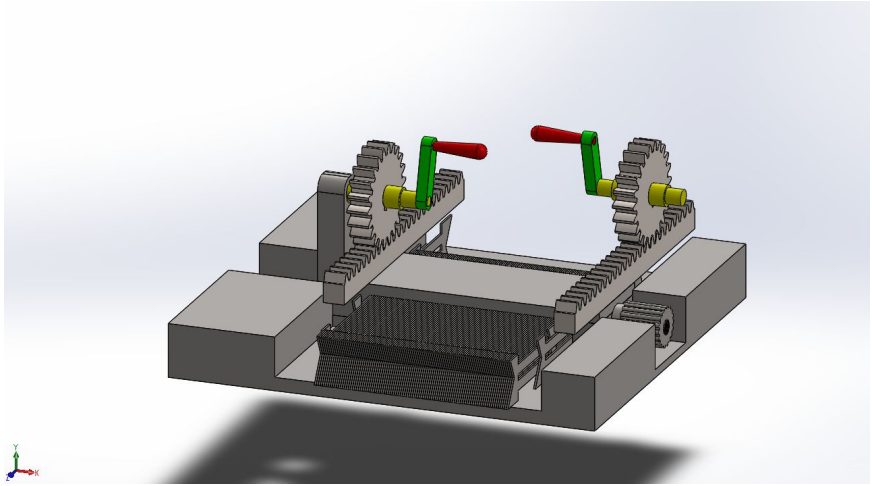
Gripper

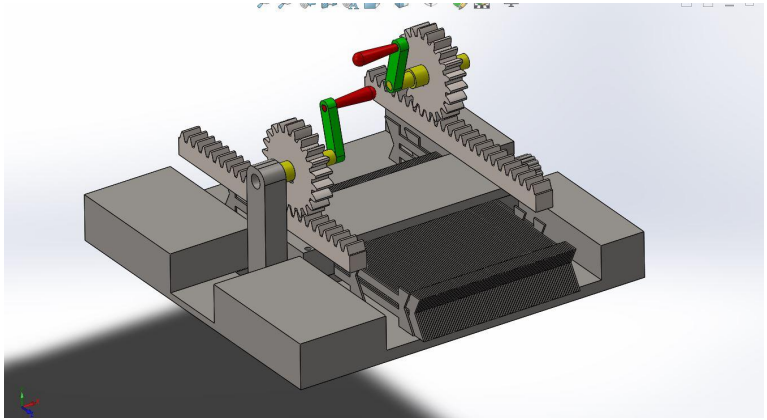
The idea:

The contour gauge tool is used to record the cross-sectional shape of a surface.

Two contour gauges will slide from around the object taking its shape and grabbing onto it. This will secure the object for it to be lifted then put down in the microwave.

Gripper prototype





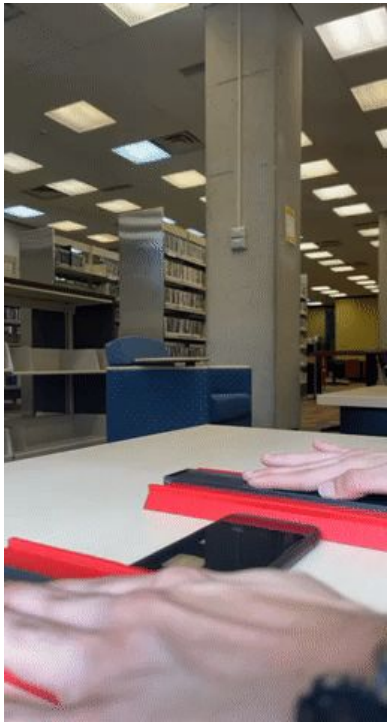
The works

-Thin plastic pieces placed next to each other to create a gripping mechanism

-The plastic are held together with a frame and Knob to tighten the position

-A rack and pinion is attached on both sides to allow for gripping and release

-The handles can be replaced with a motor and a shaft running across both gears to create stability



Bill of materials

- Most parts can be 3d printed

Plastic pieces	85-120 pcs	free
Plastic frames	3 pcs	free
Gears	2-6	<10$
Motor	1-2	<10$
Rack || PLastic // Metal	2 pcs	Plastic | free // Metal | 10-25$

Project Plan

In the near future we plan to:

- Get client feedback
- Revise design with client feedback
- Reduce our design cost to $100
- Order Parts for Prototype 2
- Design electronic controller and UI

Thank You

Questions?