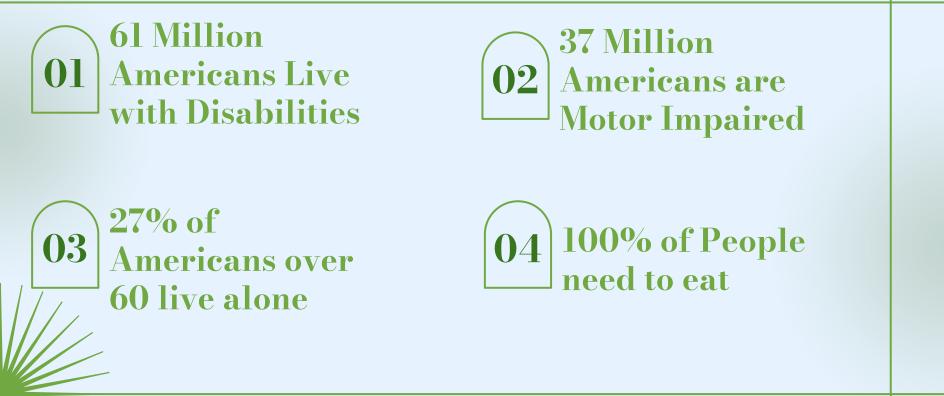




A creative solution for assisted cooking



#### The Problem





#### Needs Statement

In a country where one in four adults have some form of motor impairment and older adults are more likely to live alone, there's a serious need for tools that can make tasks easier for motor impaired adults



#### The Mission

#### Accessibility

Assist those who find it difficult to or are unable to cook alone

27%

Aged over 60 live alone

#### Convenience

Provide an easier, more convenient way to prepare meals

#### Goal

Make cooking, specifically spice measurement, more accessible for people with motor impairments

### Goals and Objectives





### Accessibility

S.P.I.C.E. aims to make cooking accessible for everyone



#### Convenience

Providing an exceptionally convenient way of preparing meals



### Easy Maintenance

S.P.I.C.E. will be easy to use and maintain

















**TasteTro** 



#### **TasteTro**

- Commercially advertised since Jan. 2018
- Simple 3-button interface, unique spice storage and distribution mechanism
- Operates on predetermined recipes; S.P.I.C.E. intends to consider individual spice selection as well





## Automatic Spice Dispenser



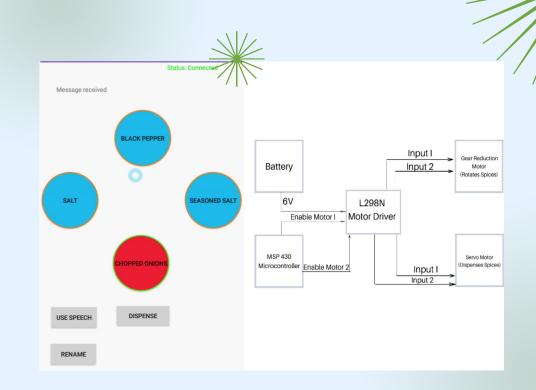
### Automatic Spice Dispenser

- Can hold up to 10 spices
- Maximum dispensing time of 10 seconds
- Accurate to a tenth of a gram
- Doesn't incorporate UI; S.P.I.C.E. intends to



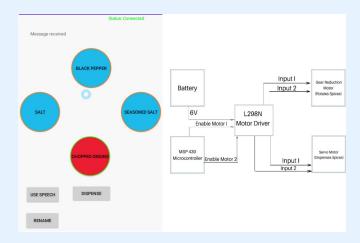


Spicer



### **Spicer**

- Can hold up to 8 spices
- Connects to a mobile app for easy interaction
  - S.P.I.C.E intends to have a similar functionality
- Capable of detecting hand gestures to control some functionalities





#### MeasureMINT



#### MeasureMINT

- Holds up to 12 spices
- Can dispense spices in various quantities (down to 1/8 tsp) based on user input
- UI could be more efficient; may be time consuming for the user to input the data
  - One of S.P.I.C.E.'s goals is to have an easy-to-use UI
- Uncertain how the recipe component of MeasureMINT works
  - S.P.I.C.E. intends to incorporate a networking component for this functionality



## Fab Academy Final Project



### Fab Academy Final Project

- Similar to MeasureMINT
  - Single motor used for carousel functionality
  - Sliding shaft to connect the motor to the dispensing mechanism
- Dispenses slowly
- Doesn't incorporate specific measurements and UI

S.P.I.C.E. intends to include a selection of different spice measurements with

the UI



#### **Literature Conclusion**

- There are many similar ideas, BUT our team can see what other teams had problems with and find solutions to them
  - Inefficiency
- Every implementation is missing key accessibility components
  - Lack of UI
  - Lack of accurate measurement capability





#### **Product Links**

- https://www.tastetro.com/
- https://jeffreywangdesign.com/SeniorDesign.ht ml
- https://www.ece.ucf.edu/seniordesign/sp2020s u2020/g10/assets/files/8PagePaperFinal.pdf
- https://www.reddit.com/r/3Dprinting/comment s/n2nb85/ive\_seen\_some\_recent\_interest\_in\_ spice\_racks\_so\_i/
- https://fabacademy.org/2022/labs/kochi/stude nts/muhammed-fahiz/projects/final-project/



# Design Objectives







#### Accessibility

- The system must support at least 4 different spices
- Minimum spice measurement of 1 teaspoon
- The distribution of spices must be accurate to <u>+</u> 0.1 teaspoon
- Larger buttons and bigger text for those with bad eyesight



#### Convenience

- The system should fit in a 45x45x45cm box
- The system should feature a mobile application or intuitive interface
- The overall design must have a reasonable level of water resistance
- The system must be able to properly function in the temperature range 65-75F (18-23C)





### Easy Maintenance

- The system must be modular and easy to change spices
- The system must be easy to clean
- The system must operate efficiently for the user

### Design Constraints & Feasibility

- Performance
  - Measurement accuracy
- Functionality
  - o Large buttons on UI
- Economic
  - Development ideally will not exceed \$200
- Operational
  - o Should be able to operate within a reasonable temperature range
  - Must fit on kitchen counters
  - Wireless communication
- Usability
  - Users should be able to learn to operate the system within 30 minutes

### Proposed Design/Key Features





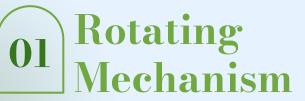
- Touch Screen
- Small Bowl for ease of mixing
- Quick Dispensing



- Modular Compartments
- Ease of Access

#### **Alternative Solutions**





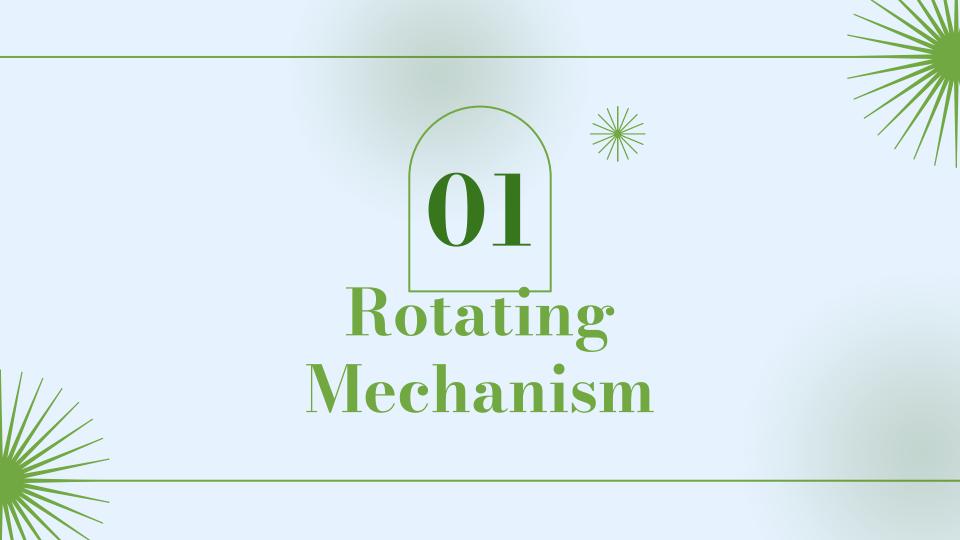






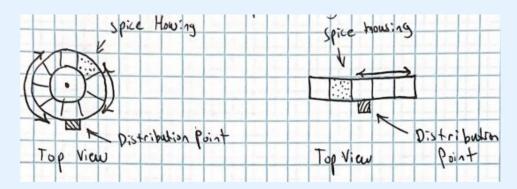






### Rotating Mechanism

- Original idea was a linear design where each spice would have tubes that funnel into a central distribution tube.
  - o Issues with this were it's less efficient than a rotating mechanism and it makes the software development aspect of the project harder.
- A rotating mechanism would take up more space, but it is outweighed by solving the issues described above. A rotating design also eliminates the need for multiple distribution points.



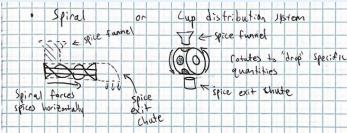




#### Spiral Mechanism

- A spiral mechanism was used in many other projects that provided a similar solution to S.P.I.C.E.
  - Corkscrews can be 3D printed, but each spice housing would need one. The budget for the project is already slightly over the limit, and this would push it even further.
- An improved design would be to use a sliding shaft that can connect and retract from each spice housing.
  - o This reduces the overall number of motors needed

 This idea might be challenging to implement with a rotating spice mechanism.







### Recipe & Individual Spice Options

- Recipe Support PROS
  - Useful for mixing spices together
  - User doesn't have to know exact spices they want
  - o Provides unique functionality not found in other similar products
- Recipe Support CONS
  - o Requires a recipe parsing algorithm
  - Device must contain ALL the proper spices specified
- Individual Spices PROS
  - Useful if user only needs one type of spice
- Individual Spices CONS
  - For multiple spices, machine must run multiple times







#### Mobile Application vs. Interface

- Mobile Application PROS
  - o Convenience user doesn't have to be near device to work it
- Mobile Application CONS
  - Targeted audience might not be able to use smartphones or find them hard to use
  - Deemed harder to implement (requires server hosting)
- Interface PROS
  - Eliminates the need for an external device for controlling
  - Deemed easier to implement (doesn't require server hosting)
- Interface CONS
  - Less convenient to operate, user must be with the machine







### **Voice Recognition**

- Voice Recognition PROS
  - Efficiency; less button-pressing to input data
  - Unique in comparison to similar products
- Voice Recognition CONS
  - Implementation (may require integration of various API's, voice recognition libraries, ML, and the usage of other tools or technologies)
  - Doesn't have much benefit for the deaf (can't speak into the system)

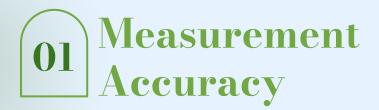


# Design Validation



#### **Validation Components**











#### Measurement Accuracy

- Test minimum measurement
- Test tolerances
- Test Accuracy while combining spices

#### **Modular Components**

- Make components fit with all mechanisms
- Survey test assembly and disassembly
- No issues with rotation or other mechanisms

#### **Ease of Operation**

- Survey Test user interface and usability
- Time how quickly SPICE can dispense
- Make sure all components are accessible with impaired motor control

# **Economic Analysis**







[03] Manufacturability



### **Economical Viability**

- S.P.I.C.E. will be highly marketable to the community
- Similar products contain features that other products don't have
  - S.P.I.C.E. intends to take inspiration from those products and integrate those features to become one working prototype
- Simplifies the difficult cooking process for elderly people living alone and those who are motor disabled
- Moderate cost since the product relies heavily on hardware and no resources are needed for the software besides the touchscreen

### Sustainability

- Many parts are available from multiple vendors.
  - Makes it easier to replace parts if anything happens to them.
- Repairs on the device should be fairly straightforward if designed properly.
- The Raspberry Pi and Arduino are the only valuable components that will be hard to replace in the event that one or both of them break.

### Manufacturability

- Tolerances are incredibly important to this design
  - Could lead to spices mixing unintentionally
  - Could cause error in amount of spices being dispensed

#### Societal Analysis

- S.P.I.C.E. is a product that is expected to encourage cooking in the sense that it simplifies the process for all demographics and not just motor disabled people
  - Makes cooking less tedious for people since it eliminates the need to manually measure out spices when seasoning food
- Expected to greatly improve the quality of food and reduce the amount of error in seasoning food
  - Promotes the well-being of people by helping them produce high quality food

### Safety Analysis

- To avoid personal injuries, the S.P.I.C.E will be designed in such a way that hides all critical and potentially dangerous components within its container. Not only does this protect the various components from outside damage, but also protects the user when interacting with the device.
- When building the device, we will ensure that all components are fastened tightly and neatly organized within the container to avoid potential breakdown of the device which could endanger the user.

#### **Environmental Analysis**

- If possible, the team would like to use recycled plastic for 3D printing various components for the device.
- The finished product should not have any impact on the environment, as it is a household product and should not contribute to existing environmental issues such as pollution.

## Budget

Item	Quantity	Cost Per Item	Total Cost
Servo Motors	2	\$14.99	\$29.98
ESP32 WROOM	1	\$11.00	\$11.00
Raspberry Pi Touch Screen	1	\$108.00	\$108.00
Raspberry Pi Zero W	1	\$74.95	\$74.95
Brown PLA 1.75mm (1kg)	1	\$19.99	\$19.99
High Torque DC Motor	1	\$30.72	\$30.72
Total			\$274.64





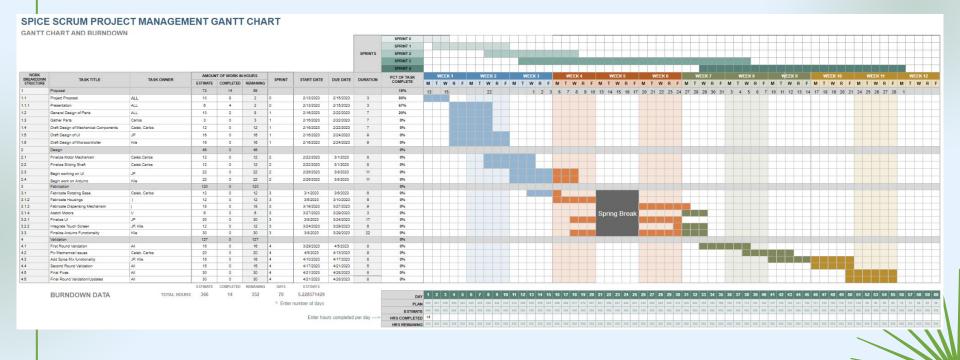
#### The Team

Role	Member(s)			
Project Manager	Carlos Zapata III			
Mechanical Design				
<ul><li>Component Modeling</li><li>Material Acquisition</li><li>Hardware Placement</li></ul>	<ul> <li>Caleb Herrera, Carlos Zapata III</li> <li>Carlos Zapata III</li> <li>Caleb Herrera</li> </ul>			
Software Design				
<ul><li>UI Designer</li><li>Microcontroller Specialist</li><li>Hardware Networking</li></ul>	<ul> <li>JP Bartsch</li> <li>Kile Zimmermann</li> <li>JP Bartsch, Kile Zimmermann</li> </ul>			
Validation Lead	JP Bartsch			

#### Task Outline

WORK BREAKDOWN STRUCTURE	TASK TITLE	TASK OWNER	AMOUN	AMOUNT OF WORK IN HOURS					
			ESTIMATE	COMPLETED	REMAINING	SPRINT	START DATE	DUE DATE	DURATION
1	Proposal		73	14	59				
1.1	Project Proposal	ALL	10	8	2	0	2/13/2023	2/15/2023	3
1.1.1	Presentation	ALL	6	4	2	0	2/13/2023	2/15/2023	3
1.2	General Design of Parts	ALL	10	2	8	1	2/16/2023	2/22/2023	7
1.3	Gather Parts	Carlos	3	0	3	1	2/16/2023	2/22/2023	7
1.4	Draft Design of Mechanical Components	Caleb, Carlos	12	0	12	1	2/16/2023	2/22/2023	7
1.5	Draft Design of UI	JP	16	0	16	1	2/16/2023	2/24/2023	9
1.6	Draft Design of Microcontroller	Kile	16	.0	16	1	2/16/2023	2/24/2023	9
2	Design		46	0	46				
2.1	Finalize Motor Mechanism	Caleb, Carlos	12	0	12	2	2/22/2023	3/1/2023	8
2.2	Finalize Sliding Shaft	Caleb, Carlos	12	0	12	2	2/22/2023	3/1/2023	8
2.3	Begin working on UI	JP	22	0	22	2	2/26/2023	3/8/2023	11
2.4	Begin work on Arduino	Kile	22	0	22	2	2/26/2023	3/8/2023	11
3	Fabrication	Tue	120	0	120				
3.1	Fabricate Rotating Base	Caleb, Carlos	12	0	12	3	3/1/2023	3/6/2023	6
3.1.2	Fabricate Housings	I	12	0	12	3	3/5/2023	3/10/2023	6
3.1.3	Fabricate Dispensing Mechanism	1	18	0	18	3	3/19/2023	3/27/2023	9
3.1.4	Atatch Motors	v	6	0	6	3	3/27/2023	3/29/2023	3
3.2.1	Finalize UI	JP	30	0	30	3	3/8/2023	3/24/2023	17
3.2.2	Integrate Touch Screen	JP, Kile	12	0	12	3	3/24/2023	3/29/2023	6
3.3	Finalize Arduino Functionality	Kile	30	0	30	3	3/8/2023	3/29/2023	22
4	Validation		127	0	127				
4.1	First Round Validation	All	16	0	16	4	3/29/2023	4/5/2023	8
4.2	Fix Mechanical Issues	Caleb, Carlos	20	0	20	4	4/5/2023	4/13/2023	9
4.3	Add Spice Mix functionality	JP, Kile	16	0	16	4	4/10/2023	4/17/2023	8
4.4	Second Round Validation	All	15	0	15	4	4/17/2023	4/21/2023	5
4.5	Final Fixes	All	30	0	30	4	4/21/2023	4/28/2023	8
4.6	Final Round Validation/Updates	All	30	0	30	4	4/21/2023	4/28/2023	8

#### Task Timeline (Gantt Chart)



# Thanks

Do you have any questions?

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