ME1.02 – Soft Robotic Gripper

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Mission Statement

Design a soft robotic gripper that gently handles delicate fruits while minimizing damage and improving handling efficiency in commercial and industrial applications.

Primary Markets
Produce Retailers
Packaging & Processing

Secondary Markets
Manufacturing
Material Handling

Stakeholders

Farmers | Produce Retailers | Manufacturing | FDA

Customer Needs

A total of 33 customer needs were identified. The 5 shown below are the primary needs.

#	Customer Need	Importance
1	Gentle & Prevents Damage	5
2	Efficiency	5
3	Intelligent & Accurate	5
4	Reliable	5
5	Sanitized & Safe	5

Competitive Products


Soft Gripper


SFG-FNC3-N2027


Capio Robotics


Gentle Duo Touch

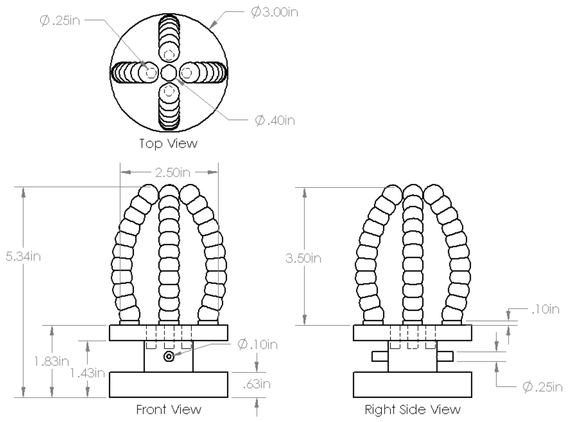
Concept Screening

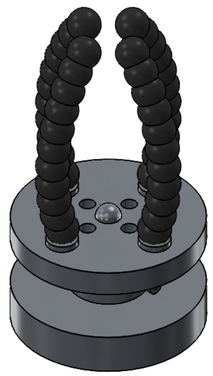
16 Concepts → (Team Consensus) → 12 Concepts → (Screening) → 6 Concepts → (Scoring) → Proposed Concept

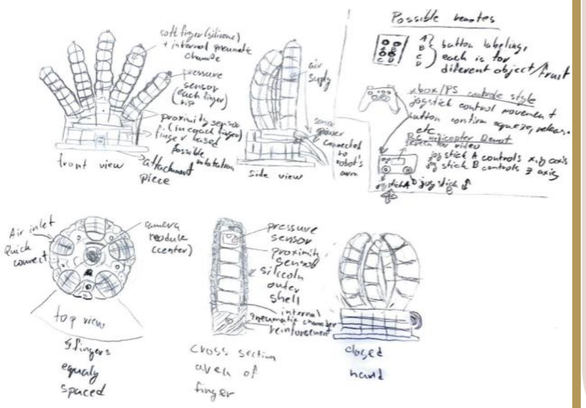
Proposed Product Concept

Pneumatic, Remote Controlled, Finger Like, Pressure, Proximity, and Image Recognition

Our final concept design is a pneumatic soft robotic gripper designed to gently grasp and handle soft fruits such as peaches using flexible fingerlike actuators and an integrated control system with sensing capabilities.



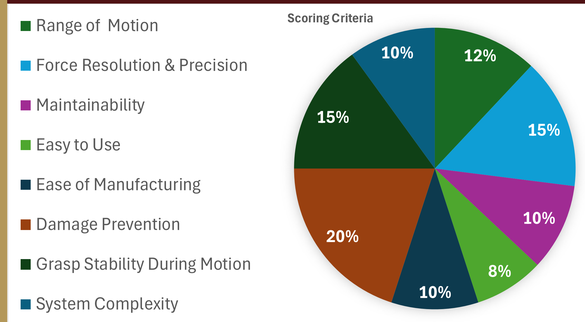




Key Benefits

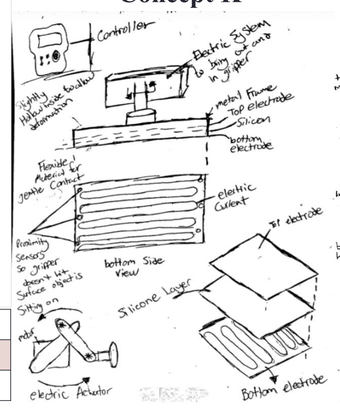
- 4 fingerlike appendages for controlled gripping
- Pneumatic actuation that allows continuous force increments
- Smart sensing capabilities (Pressure, Proximity, Image Recognition)
- Integrated control system
- Minimal external components
- Safe and sanitary design
- Independent finger control
- Symmetrical design for even force distribution

Top Contenders

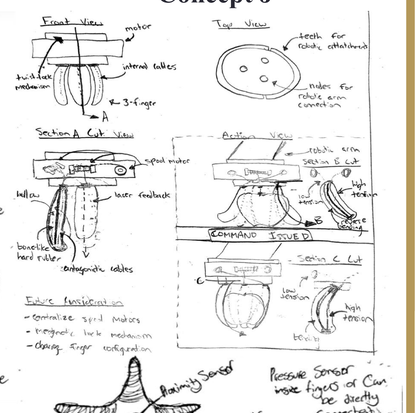


Concept	D	E	H	I	J	K
Final Score	3.74	3.41	3.43	3.03	2.72	3.49
Rank	1	4	3	5	6	2

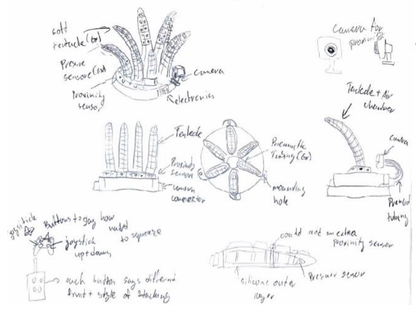
Concept K



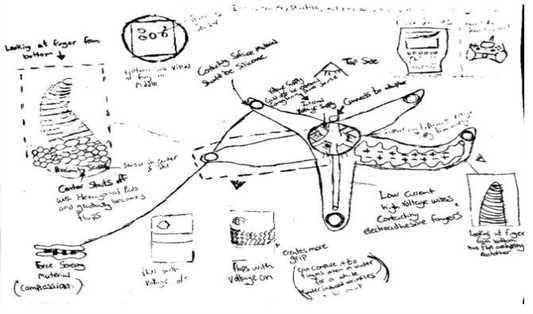
Concept J



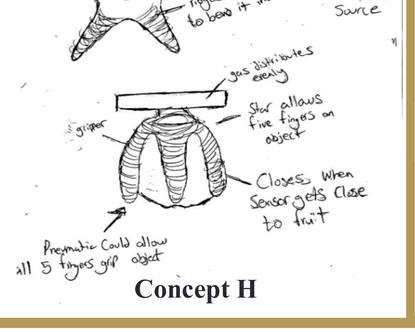
Concept E



Concept I



Concept H



Critical Subproblems

Actuation	Develop a pneumatic system that provides smooth controllable motion
Geometry	Design finger geometry and materials that conform to various fruits without applying damaging forces
Control	Implement control algorithm for pressure regulation, sensor feedback, and coordinated finger motion
Sensing	Integrate pressure, proximity, and vision sensors for safe adaptive and intelligent operation

Target specifications

Specification	Target Value
Force/Pressure Range	0-12 N
Force Sensing Tolerance	± 0.5 N
Response Time	≤ 0.5 s
Set up Time	≤ 15 min
Operating Temperature	0 – 50 °C
Fruit Variability	≥4
Tools for Operation	≤ 3
Tools for Maintenance	≤ 3

Future Plans

- Begin system-level design solutions to each critical subproblem
- Integrate design solutions and manufacture a prototype
- Test and refine prototype

Acknowledgements

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