

Insulation Cutting and Measuring Module Design Review

Team Insulation Station



Objective

- Design and build a module that scans a work order, determines the desired length, measures insulation to that length, and cuts it with minimal human input required.



Value Proposition

This project will add value to the Boeing Tubing, Duct and Reservoir Center (TDRC) by:

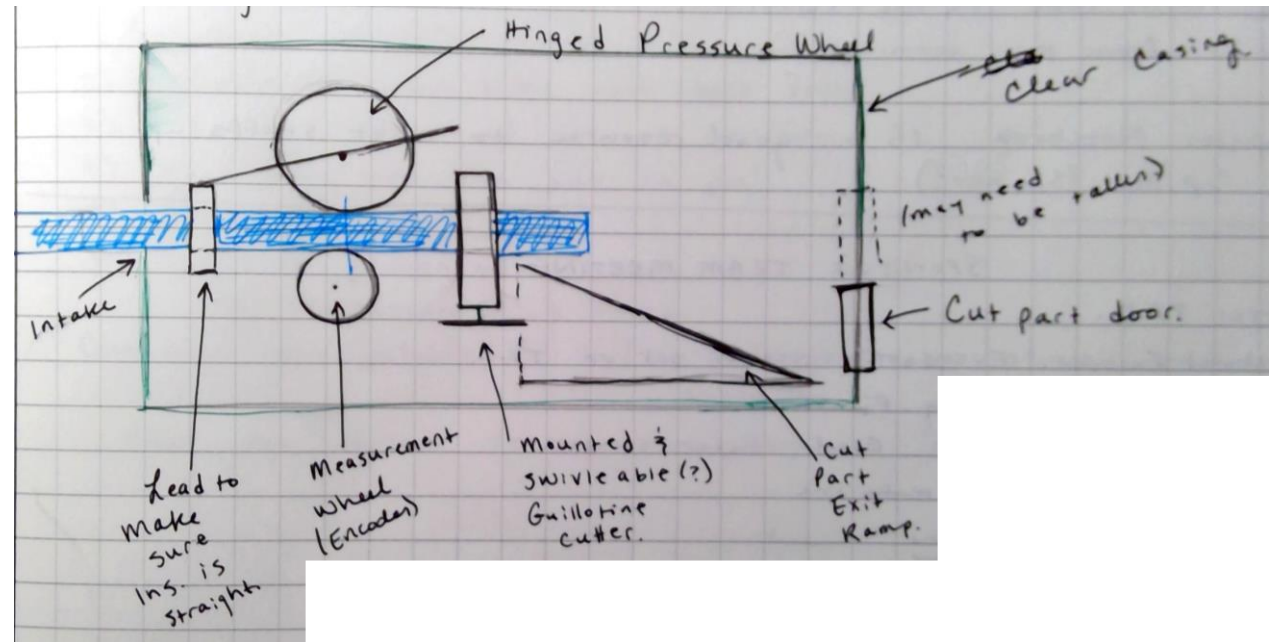
- Minimizing human error involved in cutting insulation
- Reducing cost of measuring and cutting insulation
- Minimizing time spent measuring and cutting job order

Product Requirements

- This system should take less time than the current method of cutting
- The cutter may not alter the insulation's integrity
- Measure the insulation within +/- 0.270" tolerance
- Module height/width ratio will not exceed 1/3

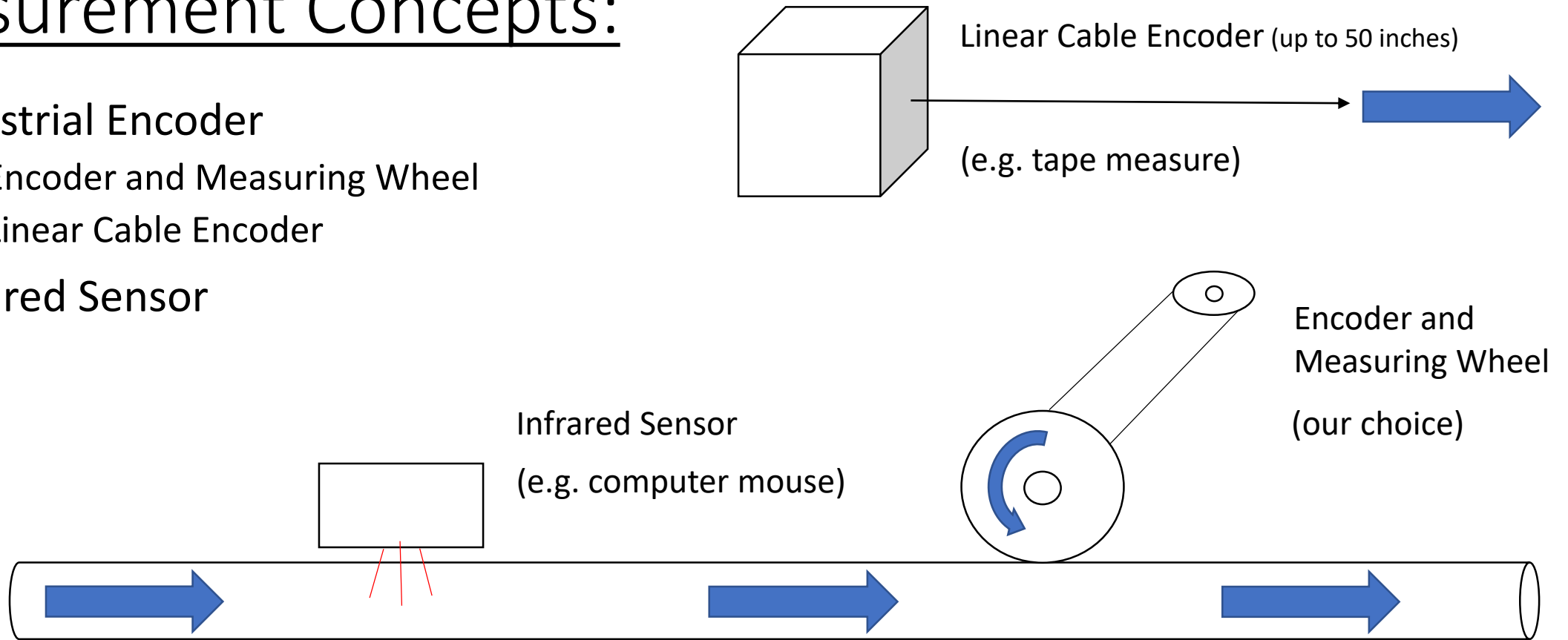
Systems

- Measurement
- Intake
- Cutter
- Programming
- Shielding



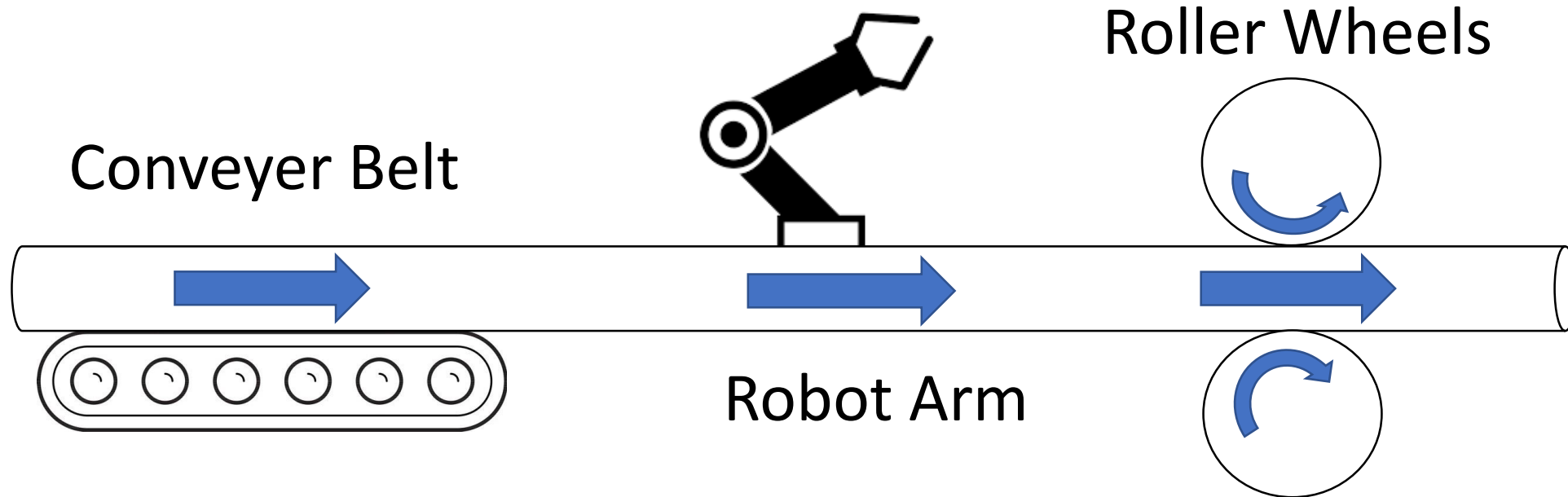
Measurement Concepts:

- Industrial Encoder
 - Encoder and Measuring Wheel
 - Linear Cable Encoder
- Infrared Sensor

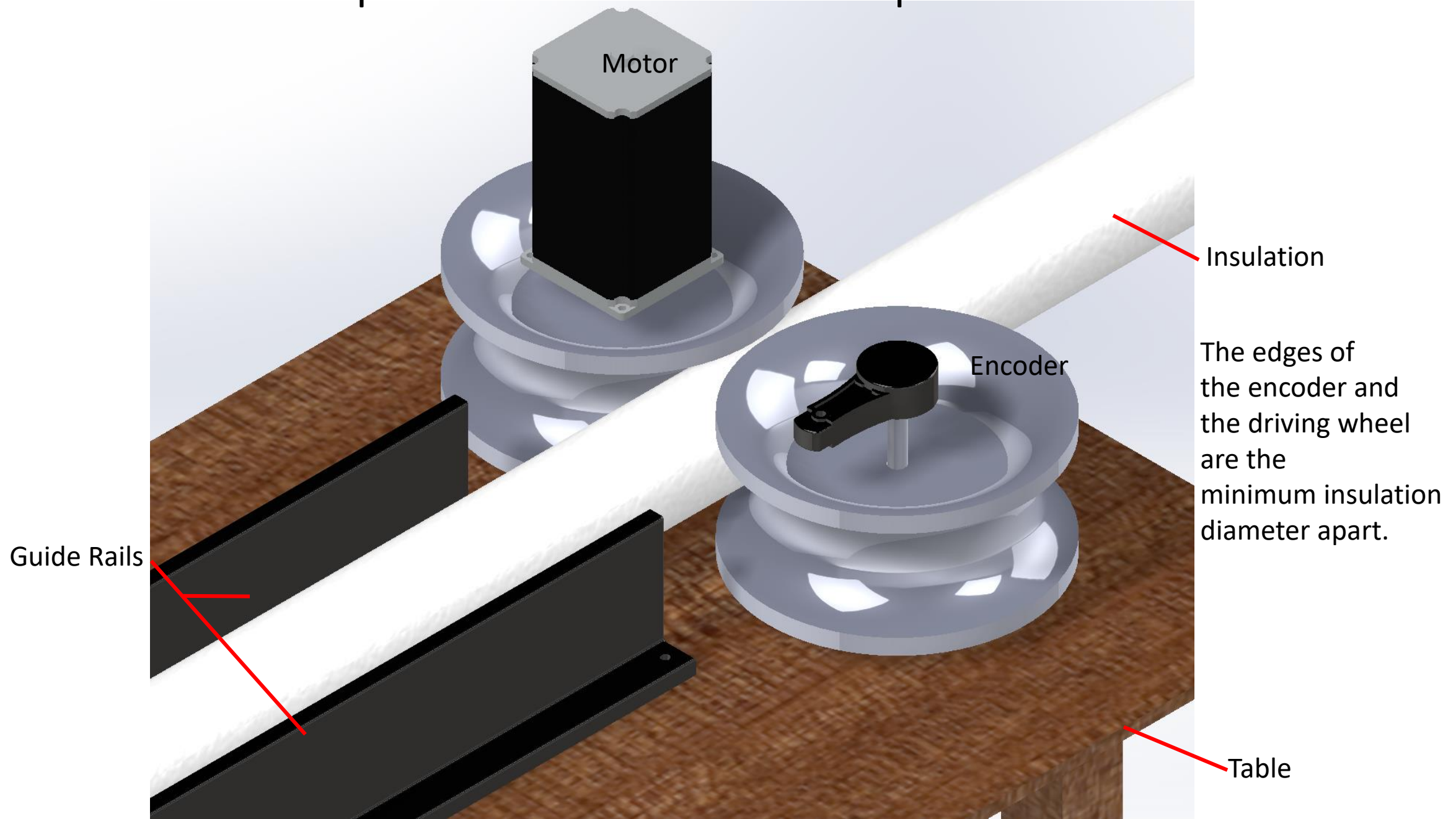


Initial Insulation Intake Concepts:

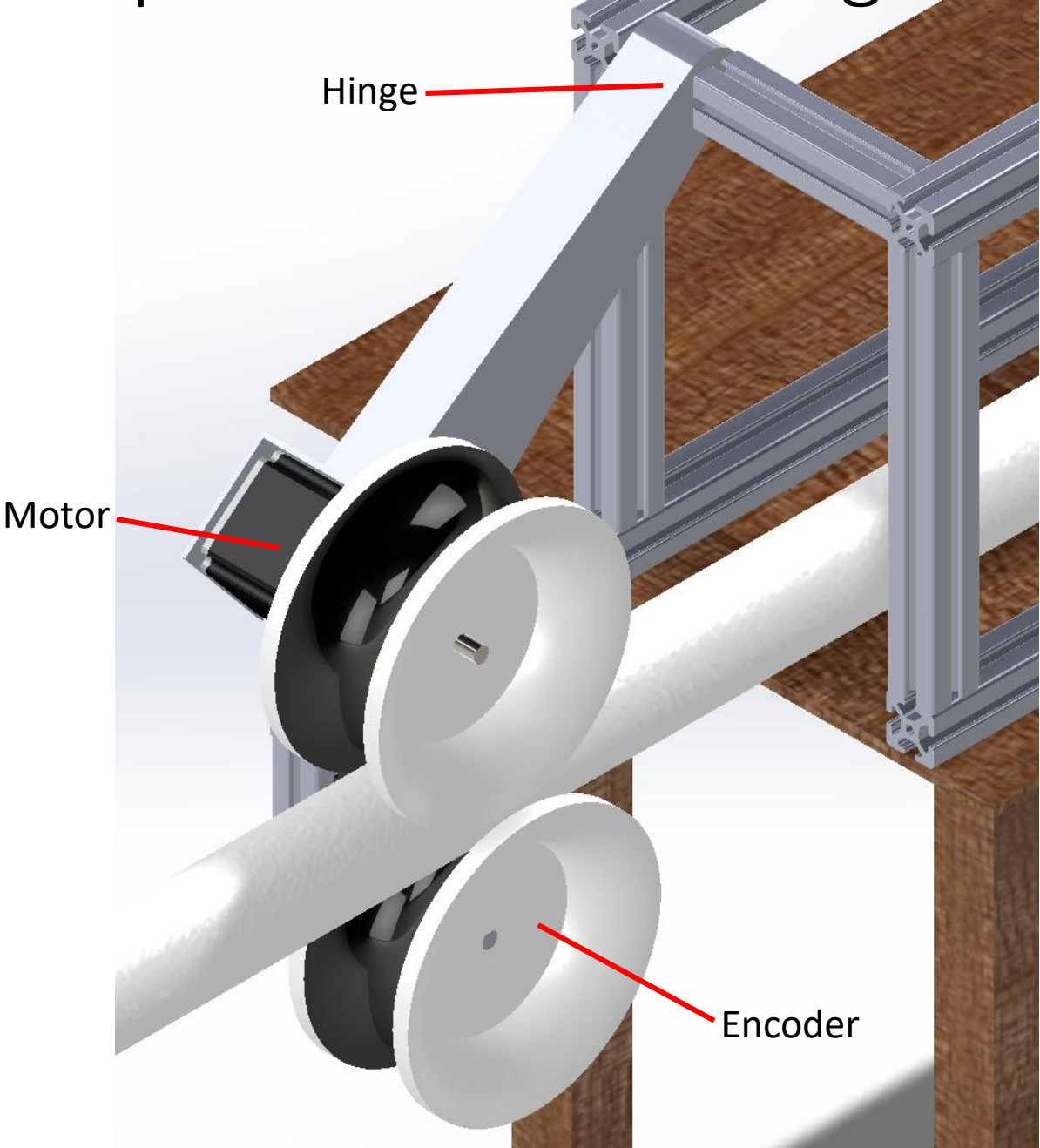
- Conveyer Belt
- Robot Arm
- Roller wheels



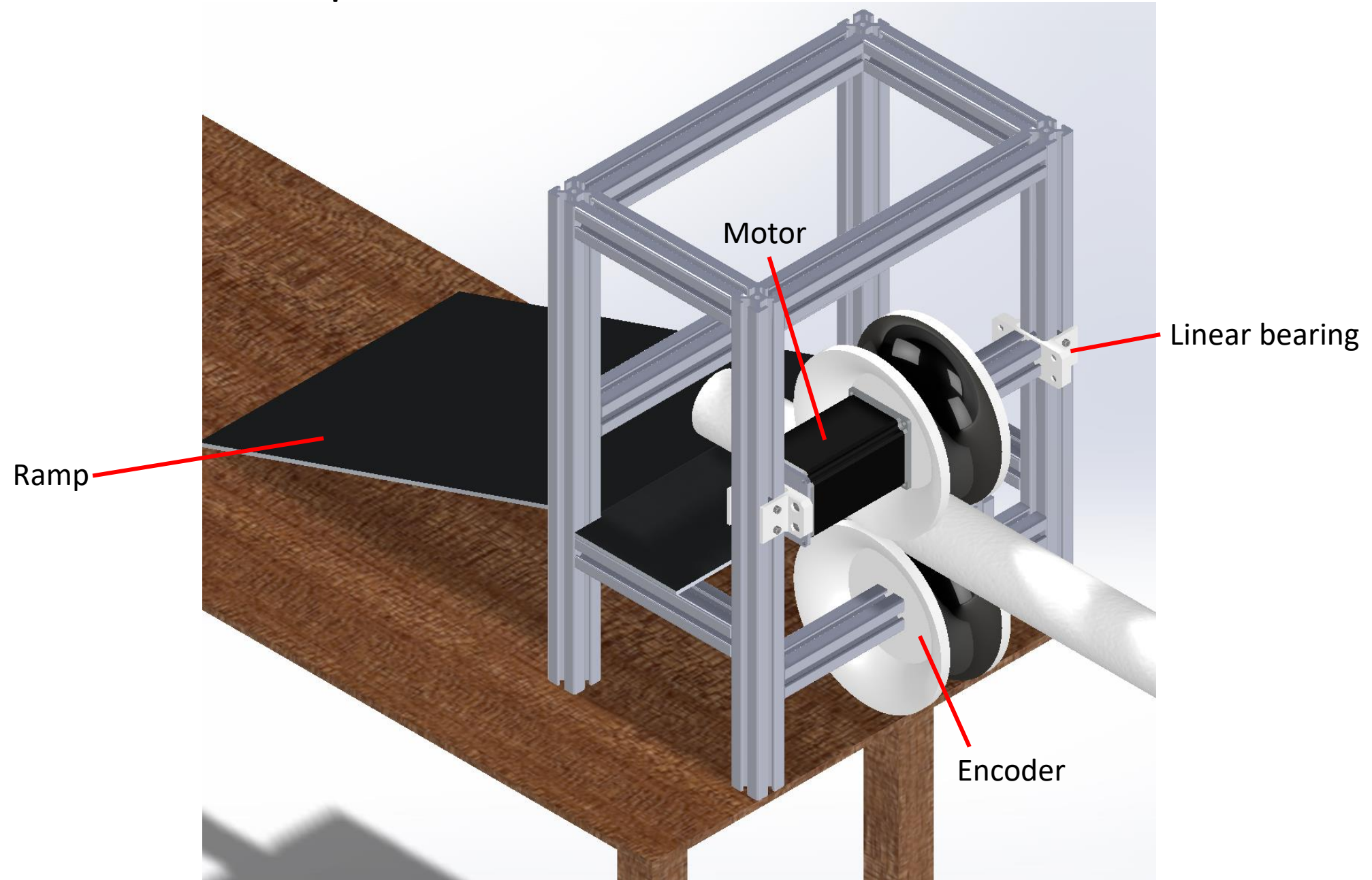
Intake Concept: The Horizontal Squeeze Method



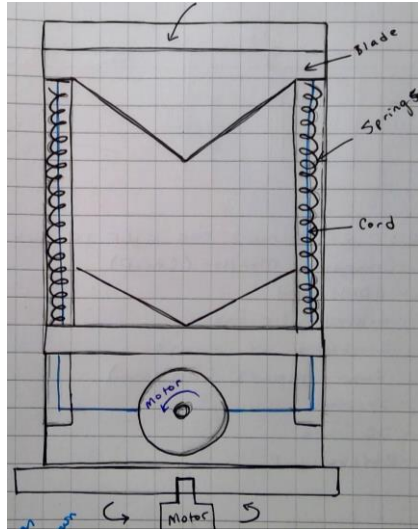
Intake Concept: The Vertical Hinged Wheel Method



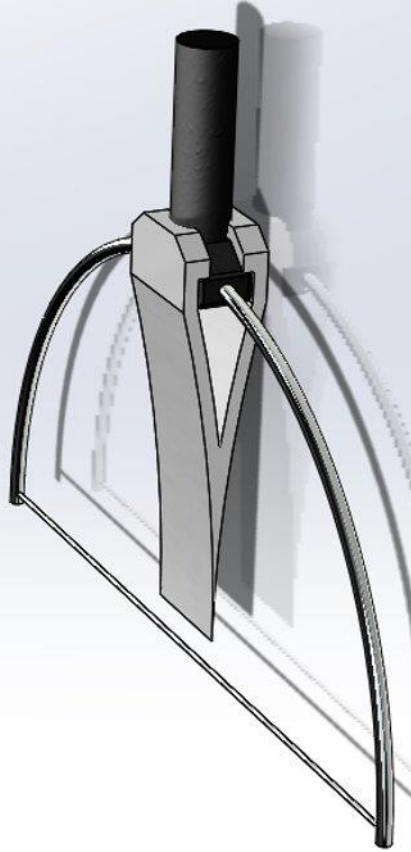
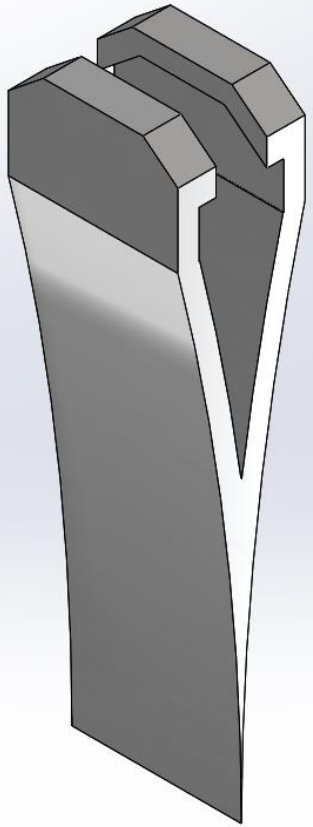
Intake Concept: The Vertical Linear Wheel Method



Cutting Considerations



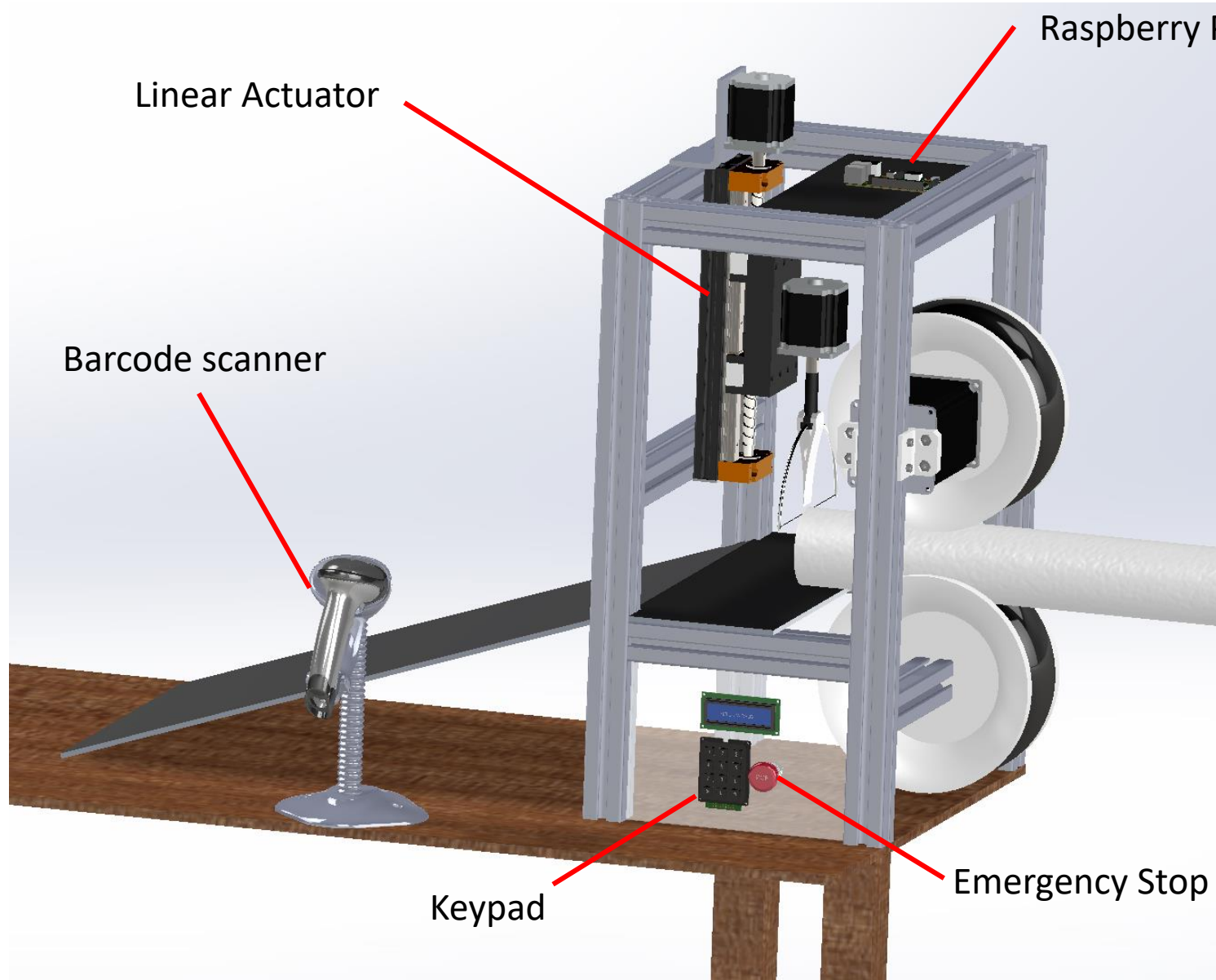
Apparatus	Pros	Cons
Guillotine	Clean slice	Lots of force required Blade dulls
Heated Wire	Heats up quickly (5 seconds) Cuts insulation easily	Wire Breaking Melts foam back together
Turkey Saw	Current Method	Debris



Current Cutter Solution

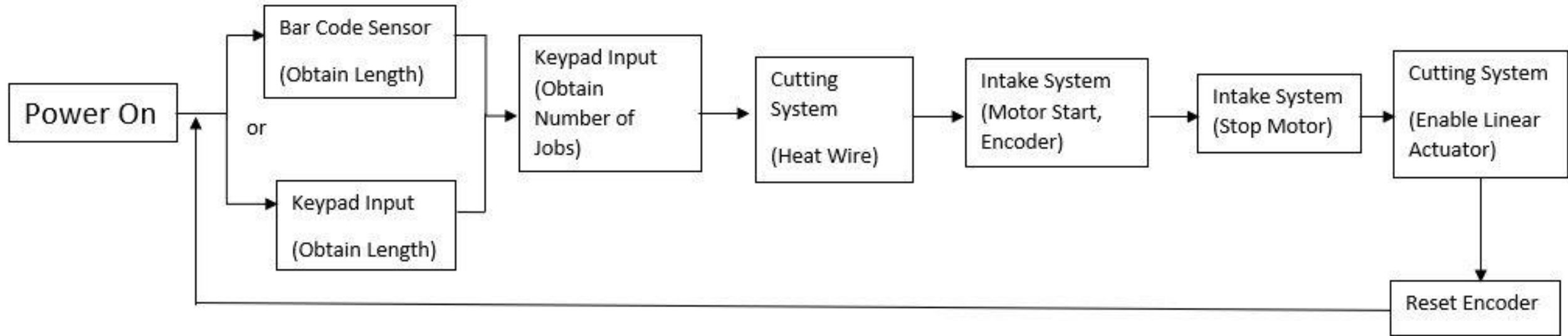
- Wedge to solve hot wire resealing problem

Current Design Recommendation



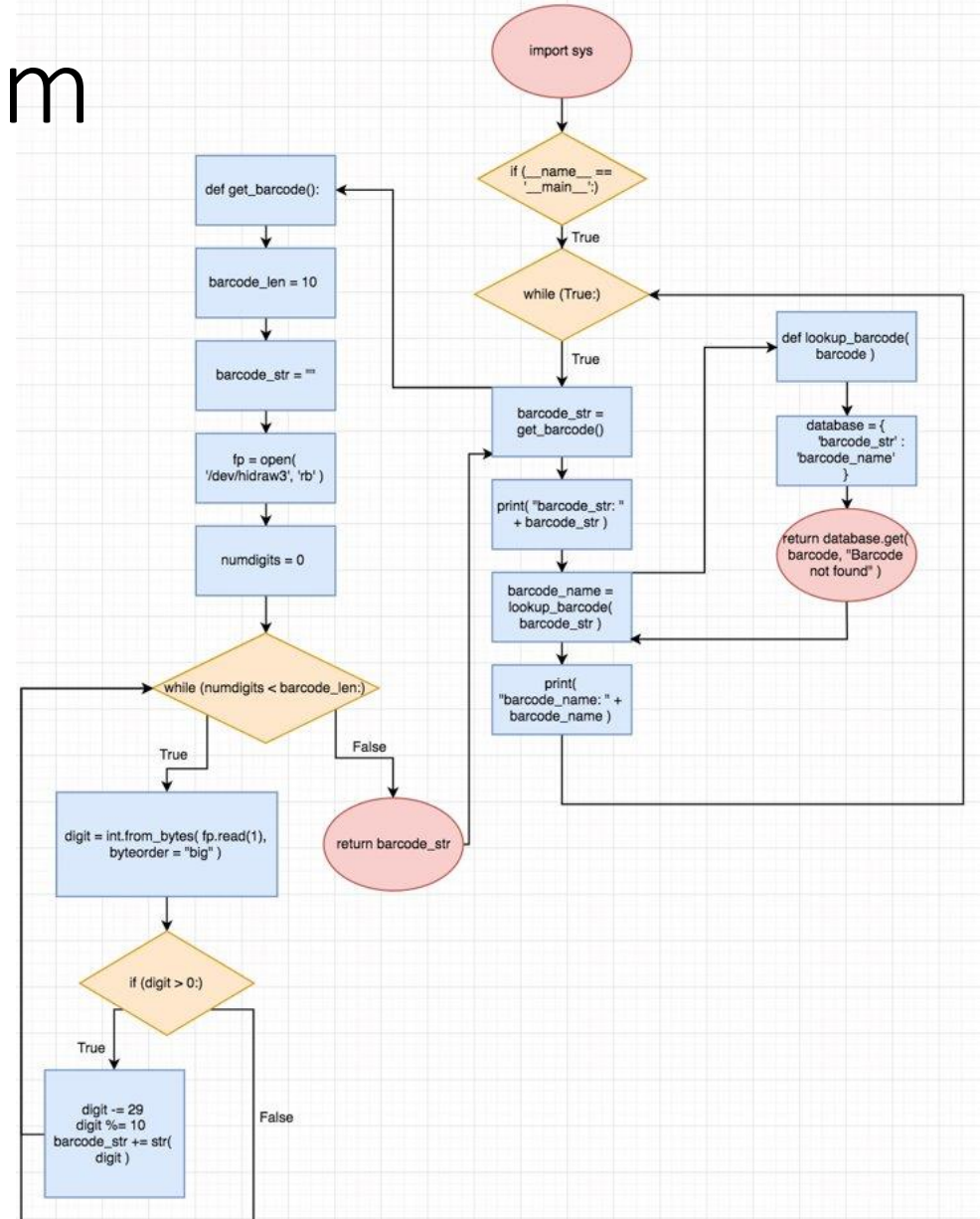
- The Vertical Linear Wheel Method
- The Modified Heated wire cutter

Programming Considerations



Current Raspberry Pi Program

- Takes inputs from a barcode scanner and outputs a cut angle and length
- Hard coded database with arbitrary assigned values
- Future iterations will interact with an existing Boeing database



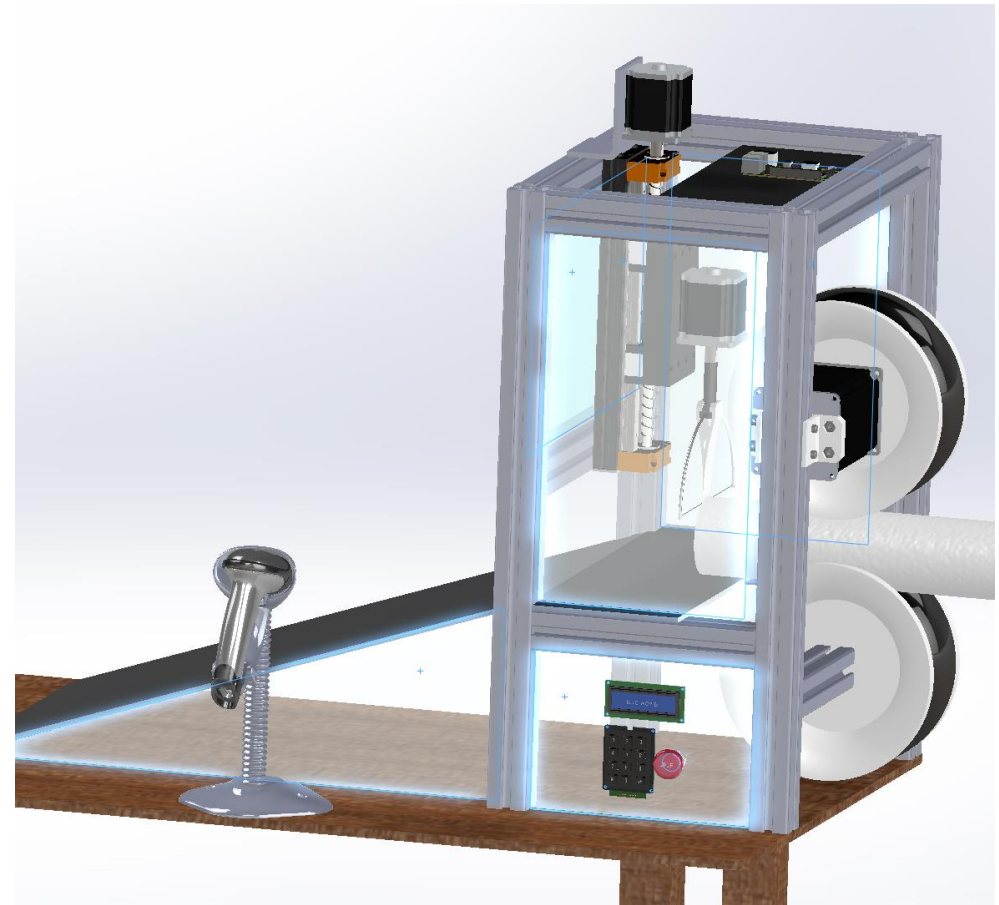
Shielding Considerations

Acrylic

- Cheaper
- Does not fade as easily
- Easy to Cut

Polycarbonate

- Easy to Drill
- Stronger
- Will not fade in set conditions



Capstone Project Budget Template - Fall/Spring

Project:	Insulation Cutting and Measuring Module								
Last Updated	11/14/2019								
	Year								Item
Expense Items	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
Equipment/Tools:									
Industrial Encoder				\$280.00					\$280.00
Stepper Motor				\$200.00					\$200.00
Wire Cutter		\$23.99							\$23.99
Linear Actuator				\$75.00					\$75.00
									\$578.99
									\$1,157.98
Supplies / Parts / Service:									
HDMI Cable		\$11.99							\$11.99
Razor Blades			\$13.79						\$13.79
8020 material				\$200.00					\$200.00
Raspberry Pi		\$59.99							\$59.99
Ribbon Cable		\$5.95							\$5.95
Keypad			\$10.00						\$10.00
Prototype Board			\$10.00						\$10.00
Project Shipping								\$100.00	\$100.00
Casing Materials (polycarb)				\$200.00					\$200.00
SD Card		\$9.95							\$9.95
Raspberry Pi Power Supply		\$11.99							\$11.99
									\$633.66

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Key Milestones:

- Design Review –11/14
- Design Revision – 11/21
- Prototype Completed - 2/1
- Final Design Completed - 3/3
- Validation Plan Completed – 4/5
- Engineering Expo – 5/1

Discussion
