Design Update - Lobster Claw Meat Extraction

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Refresher

Our Client -

Eastern Fabricators - A leader in manufacturing of seafood processing machinery located in Georgetown, PEI

The Challenge -

There is a need in the seafood processing market for an automated solution which can remove the meat, undamaged, from lobster claws.

Outline

- Results from waterjet testing and how they impacted our requirements and scope
- Project management updates including budget, timeline and risks
- Final conceptual design overview
- Life cycle analysis
- Next steps

Preliminary Testing - Water Jet Design

- Client requested the development of a commercialized waterjet scoring method for lobster claws.
- Zero commercial applications using this method, this necessitated preliminary testing.
- Various waterjet tests performed, pressures ranging from 4000-8000 psi and tip velocities of 30-70 inches/min.
- Goal of these tests was to find a pressure range and velocity that the claw could successfully be scored at without damaging the meat.

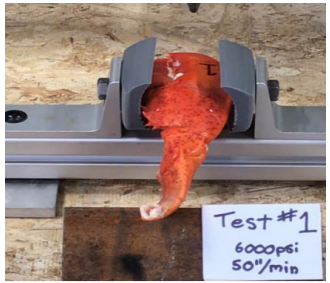


Figure 1 - Claw Grip Jig

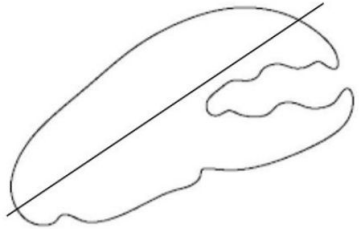


Figure 2- Cut Orientation

Preliminary Testing - Results and Conclusions

- Ideal pressure range 6000-8000 psi and 30-70 inch/min
- Out of 16 cuts made, 9 cuts resulted in zero damage to meat, only one cut was deemed as an acceptable result (7900 psi 70 inches/min) of the 9 cuts.
- Pressure irregularities and changing Z-axis led to the idea that waterjet may not be feasible.
- Water jet has been deemed outside of project scope.
- Food grade blade system now being developed.

Project Management Update

1. Updated Schedule
2. Hour Log (Current Semester)
3. Updated Budget
4. Risk Analysis

Updated Schedule

- Meeting with Eastern Fabricator (Mar.17th)
  - Finalize the design
  - Plan for Materials & Build
- Build of Prototype (Mar.18th - 31st)
  - With Eastern Fabricator / UPEI
- Test and Verification (April.1st - 12th)
  - Functional Test
  - Adjustment
- Final Design Documentation (April.12th - 20th)
  - Final PDR / Prototype
  - Design Expo

	4. Meeting with client to Discuss Preliminary Design		
	1. Go over CAD files in detail	2020-03-09	2020-03-09
	2. Discuss sourcing of materials	2020-03-09	2020-03-09
	3. Ask for feedback	2020-03-09	2020-03-09
	4. Determine timelines for production at EF	2020-03-09	2020-03-09
	5. Outline our schedule for the design course	2020-03-09	2020-03-09
	5. Build of Prototype		
	1. Send detailed drawings for review	2020-03-10	2020-03-10
	2. Purchase/obtain parts from BOM	2020-03-12	2020-03-12
	3. Construction of prototype begins at EF/UPEI	2020-03-12	2020/03/30
	4. Dealing with any revisions of design	2020-03-13	2020/03/31
	5. Construction ends	2020-03-14	2020/03/30
	6. Functional Prototype Received	2020-03-31	2020/03/31
	6. Test and Verification Review		
	1. Using test plan to verify design requirements	2020/03/31	2020/03/31
	2. Prepare safety documents for approval	2020/04/01	2020/04/06
	3. Set up experiment with necessary equipment	2020/04/02	2020/04/02
	4. Perform test for Blade choice	2020/04/10	2020/04/10
	5. Record results	2020/04/10	2020/04/10
	6. Interpret results and make relevant changes	2020/04/10	2020/04/12
	7. Send test results/changes to client	2020/04/12	2020/04/12
	7. Finish final design document		
	1. Detailed Design Review and Prototype Release	2020/04/12	2020/04/13
	2. Prepare plan to distribute work for final design docum	2020/04/12	2020/04/13
	3. Demonstrate to client that requirements have been me	2020/04/12	2020/04/12
	4. Accompanying cad files for design	2020/04/12	2020/04/12
	5. Final presentation to client and FSDE	2020/04/15	2020/04/15
	6. Final operational prototype delivered	2020/04/15	2020/04/15
	7. Design exposition	2020/04/20	2020/04/20

Hour Log (Current Semester)

Name	Main Tasks	Total Worked Hours
Eagan Boire	Writing, Formatting Documents, Editing, CAD, Meetings, Research	220
Cole Hawes	Team management, Documentation, Research, minor CAD	185
Danny Zhang	Documentation, Meetings, CAD, Research, Communication, Data Collection	165
Hugh McDonald	Documentation, Analysis, Communication Meetings, CAD, Research,	155
Malek	Documentation, Meetings, CAD, Research	175
	Total Hours:	900

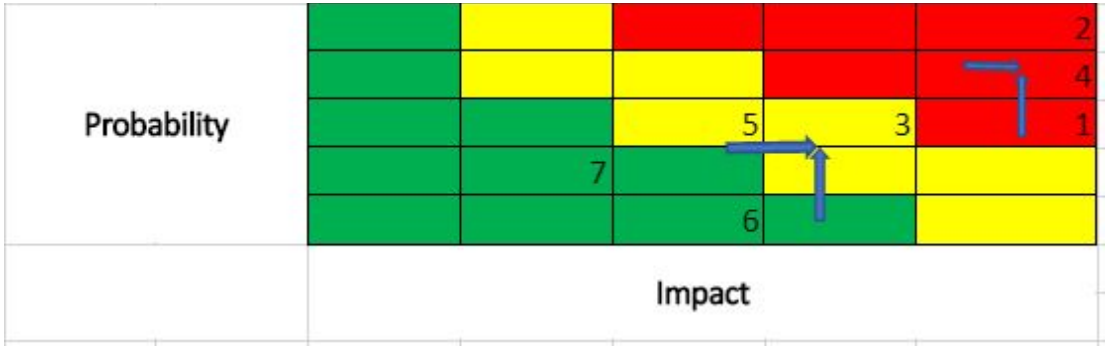
Updated Budget

This updated budget includes all the existing costs or simulated costs from the beginning of the project to now.

The total budget until now is: $32595

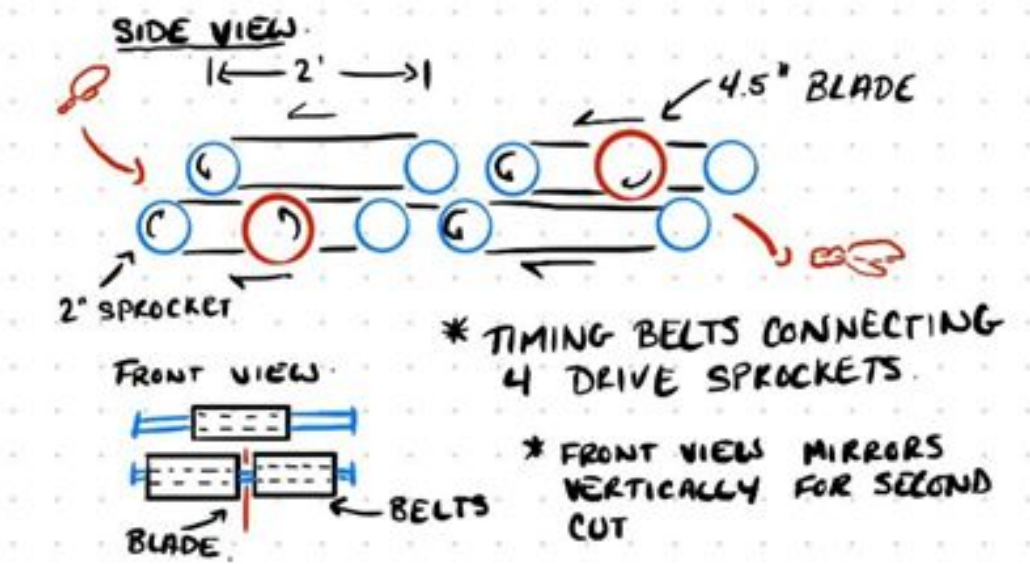
Date : Sept.8th.2019 - March.13th.2020					
Phases	Tasks	Units	Rate (CAD)	Cost (CAD)	Total (CAD)
Water Jet Test	Water Jet Fee	3	40	120	365
	Water Jet Operation	3	75	225	
	Claw Jig (3D Printed)	1	20	20	
Order of Materials	SS304 sheet metal (3'x4'x0.0178")	3	N/A	N/A	N/A
	SS316 sheet metal food grade (3'x4'x 0.0178")	3			
	SS304 angle (6' 3"x3"x¼")	4			
	More...	N/A			
Build of Prototype	Welding & Fabrication	N/A	75	N/A	N/A
	Machining and milling expertise	N/A	75		
	Electrical work & automation consultation	N/A	75		
Test & Verfication	Test Location Fee	N/A	N/A	N/A	N/A
	Test Operation Fee	N/A	N/A		
	Samples	N/A	N/A		
HR / Hour Log	Engineering Design Review	10	100	1000	32150
	Senior Engineering Design Review	16	150	2400	
	Junior Engineering Design	1150	25	28750	
Additional	Inventor 3D CAD software	5	N/A	N/A	80
	AutoCAD 2D software, Autodesk	5	N/A	N/A	
	Solidworks 3D CAD software	5	N/A	N/A	
	Claw Sample (3D Printed)	2	20	40	
	Claw Samples (BAG)	1	40	40	
				Total Budget:	***32595***

Risk Analysis



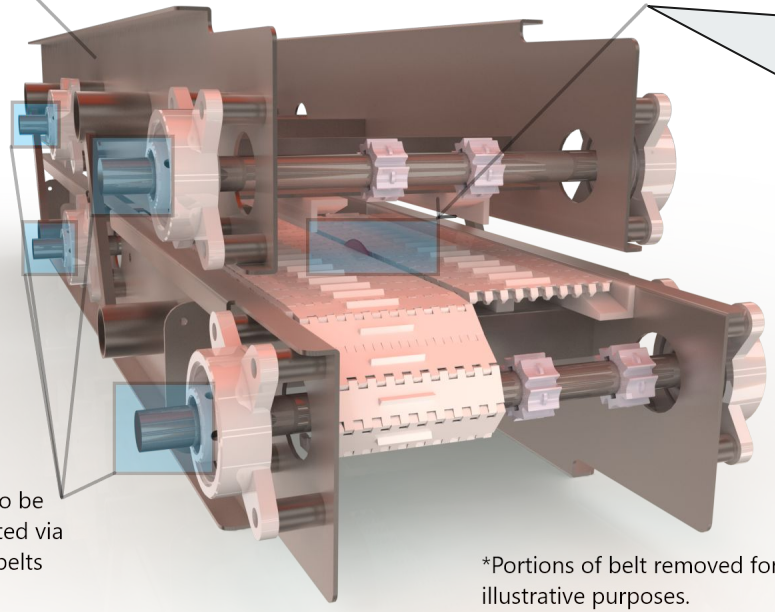
Risk number	Description
1	Having communication problems with client on pressing matters
2	Time as a constraint with respect to deliverables
3	Innacurate measurements with regards to potential future prototype
4	Losing lead time on future procurement items
5	Not having needed research items from suppliers to move into concept
6	Insufficent Professional Knowledge may cause uncertainties and dangers
7	Overloaded requirements may cause over cost and incompleted design

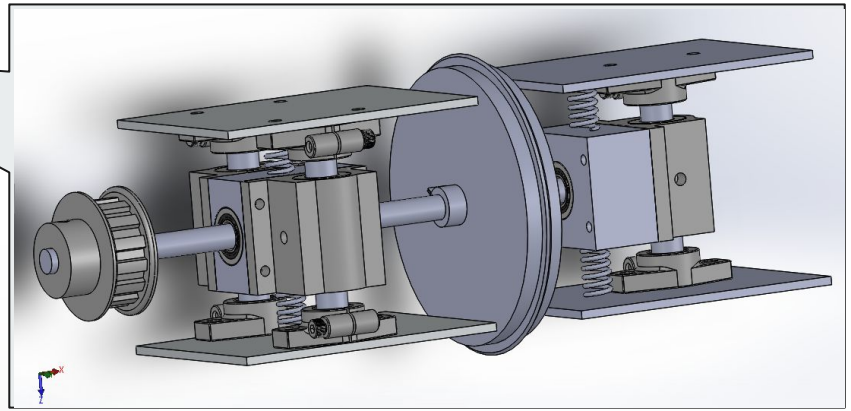
Final Prototype Design



Final Prototype Design

Vertically mirrored belt and blade arrangment





Shafts to be connected via timing belts

*Portions of belt removed for illustrative purposes.

Life Cycle Analysis

Evaluate the environmental impact of our design throughout its life cycle

Client requires our group to source from their own suppliers. Limits transportation impacts.

Stainless steel is very durable and long useful life. Easily recyclable or repurposed

Intralox ‘s belts can recycled easily through local waste management or through ECO plastics

By repurposing motors, bearings and VFD controls, Impacts can be mitigated

Source: Adapted from [1]

Next Steps

Meeting with client to show concept on Tuesday March 17 2020

Finalizing specifications and suppliers for components. (Motor, VFD, spring/damper support system)

Build prototype and perform testing to verify if requirements are met. Design iterations may be needed

Final detailed design documentation with relevant changes

Final presentation and design exposition at SSDE

Q & A

We welcome any and all questions at this time.

References

[1]“Life Cycle Analysis,” *PVthin* | *Thin Film PV Technology*. [Online]. Available: http://pvthin.org/life-cycle-analysis. [Accessed: 13-Mar-2020].