S.A.W.K Dehydrator

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Abstract

The aim of this project is to build an economical food dehydrator that relies on renewable energy. In order to do this, the team followed the engineering design process to come up with the problem, proceed with research, and to come up with design alternatives. After doing so the project started being fabricated and once it was finished the testing was conducted. During the testing the team wanted to know whether different types of mesh used on the design could have an effect on the drying of the fruits. It was found that during the testing that the bananas dried better when they were set on top of the woven mesh rather than the wired mesh. As for the apples they dehydrated just about the same on each of the types of mesh. The team concluded that the dehydrator does indeed dehydrated food and maybe some changes that could be made are regarding the fabrication for a more sealed design.

Acknowledgements

During this design process of this course the team was aided by many staff from the class and would like to take a moment to thank them. First of all, the team would like to acknowledge professor Bornhorst, Jenkins, and Mullin for their advice and help during the project. Also the teaching assistants, Lucy Knowles and Nico Buxbaum, were of great help and the team would like to acknowledge them as well. Lastly, the team wants to acknowledge Jedediah Roach and the staff from the shop in Bainer who provided a lot of assistance during the manufacturing of the design.

Introduction

The basic components of a food dehydrator is to get rid of moisture from food using some heat source. Additionally it would need a source of ventilation to generate air flow in order to get rid of the moisture that is released from heating. It was found that there are many sources of renewable energy available, such as solar, electricity, and metal conductors but it is a matter of finding which one would be most optimal for a specific design. The objective for this project is to utilize some type of renewable energy along with air flow through the food dehydrator to remove moisture from the food after it is heated by this renewable energy source. It is also

wanted, in order to dehydrate the food, that the temperature inside of the design to be higher than the outside temperature. In the end the dehydrator was able to dehydrate the food by using sunlight and it was seen that different mesh types also have different effects. This could be taken into consideration to possibly look into a mesh that work just as effect for every type of fruit. However, the change in moisture content between the two meshes are not significant which means that the design is still effic

Background

In the design by Scanlin (2014) some materials included for the dehydrator were wood, screws, nuts, and bolts to fasten the materials together. This is important to know when looking into a cost effective design so that the budget is not too high by using basic methods of putting together the design. Also an important thing to consider in the design is the metal mesh and aluminum used inside of the dehydrator which are efficient for absorbing the sun's heat. The example for the design is by Madhlopa, Jones, and Saka (2001) has adjustable vents to control airflow and has a layer of glass which will give efficient solar energy. The design has a metal heat absorber which allows for the maximum amount of heat to be absorbed at an angle which also allows the airflow to be maximized.

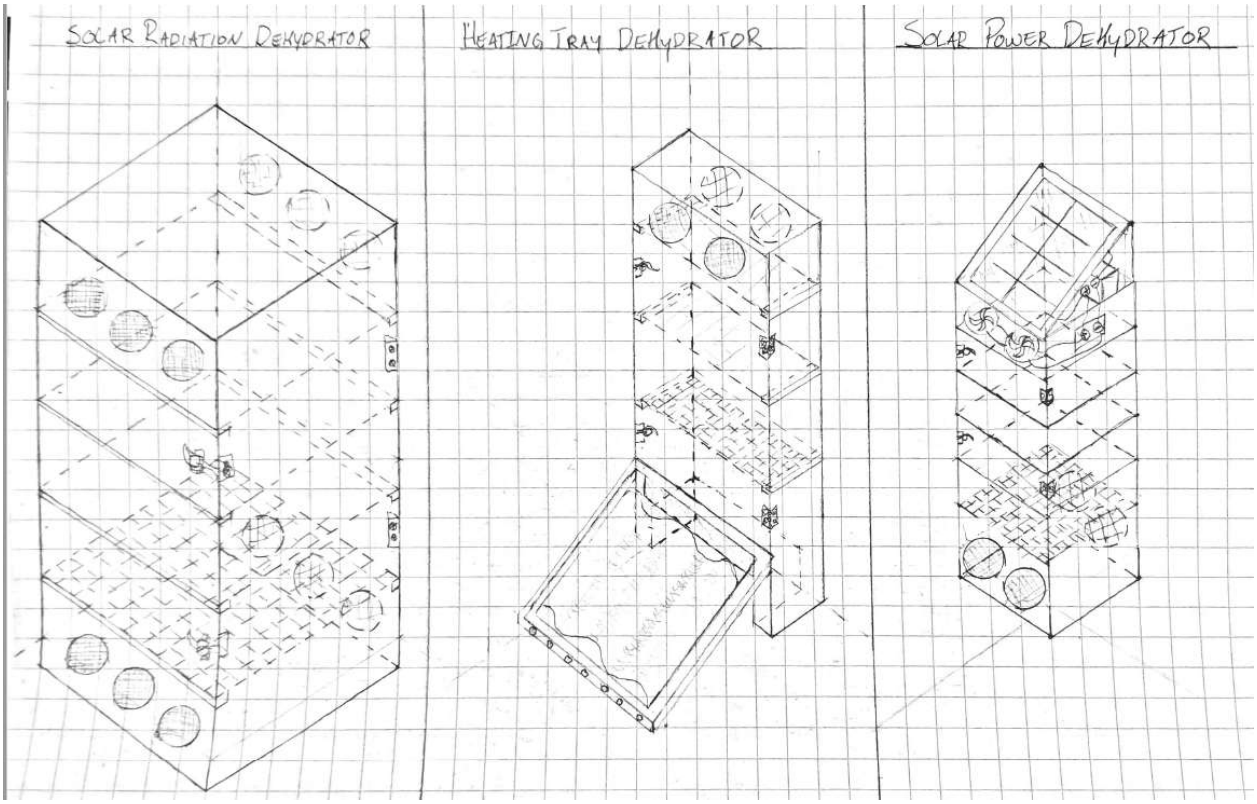
Problem Statement

The project must be constructed with $50 or less which will restrict the choice of material for project construction and to use renewable energy. The food must be safely dehydrated, so air movement and heat are essential and it must be built within 10 weeks.

Design Alternatives

There were three design alternatives: the Solar Radiation dehydrator, Heating Tray dehydrator, and lastly the Solar Power dehydrator. The Solar Radiation dehydrator is surrounded by plexiglass, includes layers of trays, and also has air vents covered by mesh (to keep bugs away) at the top and bottom most layers to create air flow. As for the Heating Tray dehydrator it is similar to the previous alternative but it as an additional component in the front which is a heating tray that absorbs heat from the sun and then transfers this heat to the box where the trays are through connection. Lastly, the Solar Power dehydrator has solar cells on top of the design

which connects to a charger controller to power the fans when there is no sun and their purpose is to circulate air and pull the moisture out of the system.



Design Selection

K-T Decision Analysis

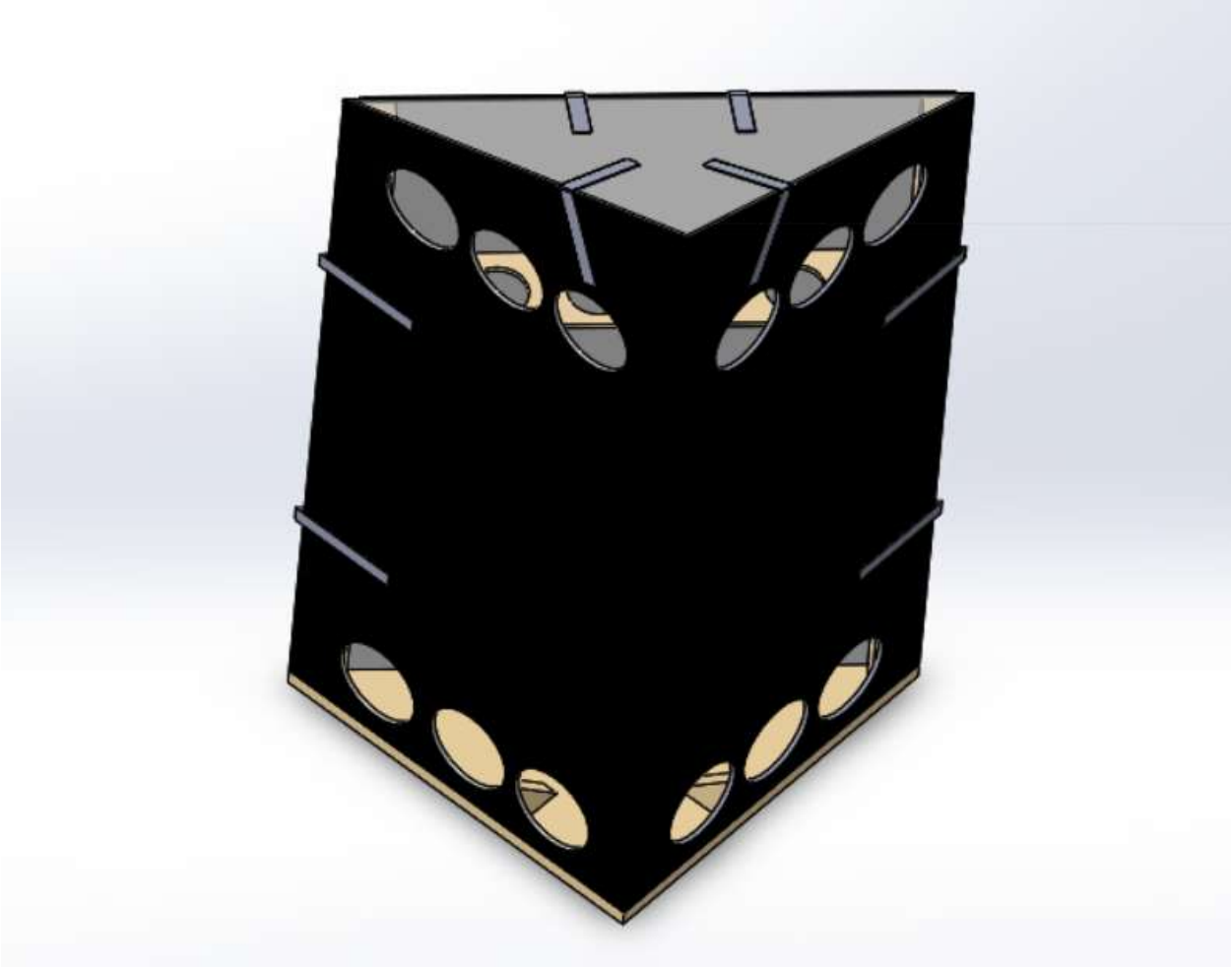
Design Alternatives		A:		B:		C:	
MUSTS		Solar Power Dehydrator		Heating Tray Dehydrator		Solar Radiation Dehydrator	
1. Dehydrate Food		Yes		Yes		Yes	
2. Renewable Energy		Yes		Yes		Yes	
3. Costs under $50		No		Yes		Yes	
4. Does not exceed 1 square meter		Yes		Yes		Yes	
5. Food dried is safe to consume		Yes		Yes		Yes	
Keep Design?		No		Yes		Yes	
WANTS	**Weight**	**Rating**	**Score**	**Rating**	**Score**	**Rating**	**Score**
Efficiency (Time taken to dry)	7	6	42	8	56	8	56
Ease of Use	3	4	12	8	24	8	24
Safe to Operate?	8	5	40	5	40	5	40
Quantity of Food Dehydrated	6	4	24	6	36	8	48
Easy to clean?	4	7	28	7	28	7	28
Environmentally-Friendly	7	3	21	7	49	7	49
Lightweight	3	6	18	6	18	7	21
Aesthetically Pleasing	3	5	15	6	18	6	18
Total Score			200		269		284

While making this diagram the "musts" were decided through the problem statement, because the restrictions in that statement were "musts" and if the design did not meet these restrictions then it will not be chosen. As for the "wants" the team decided to brainstorm things that the design could have that would be a preference and not necessarily something that the project cannot proceed without. The weights for each of the "wants" were decided based on how important the team felt each "want" was on a scale from one to ten.

Design Description

Food Dehydrator Assembly

View 1



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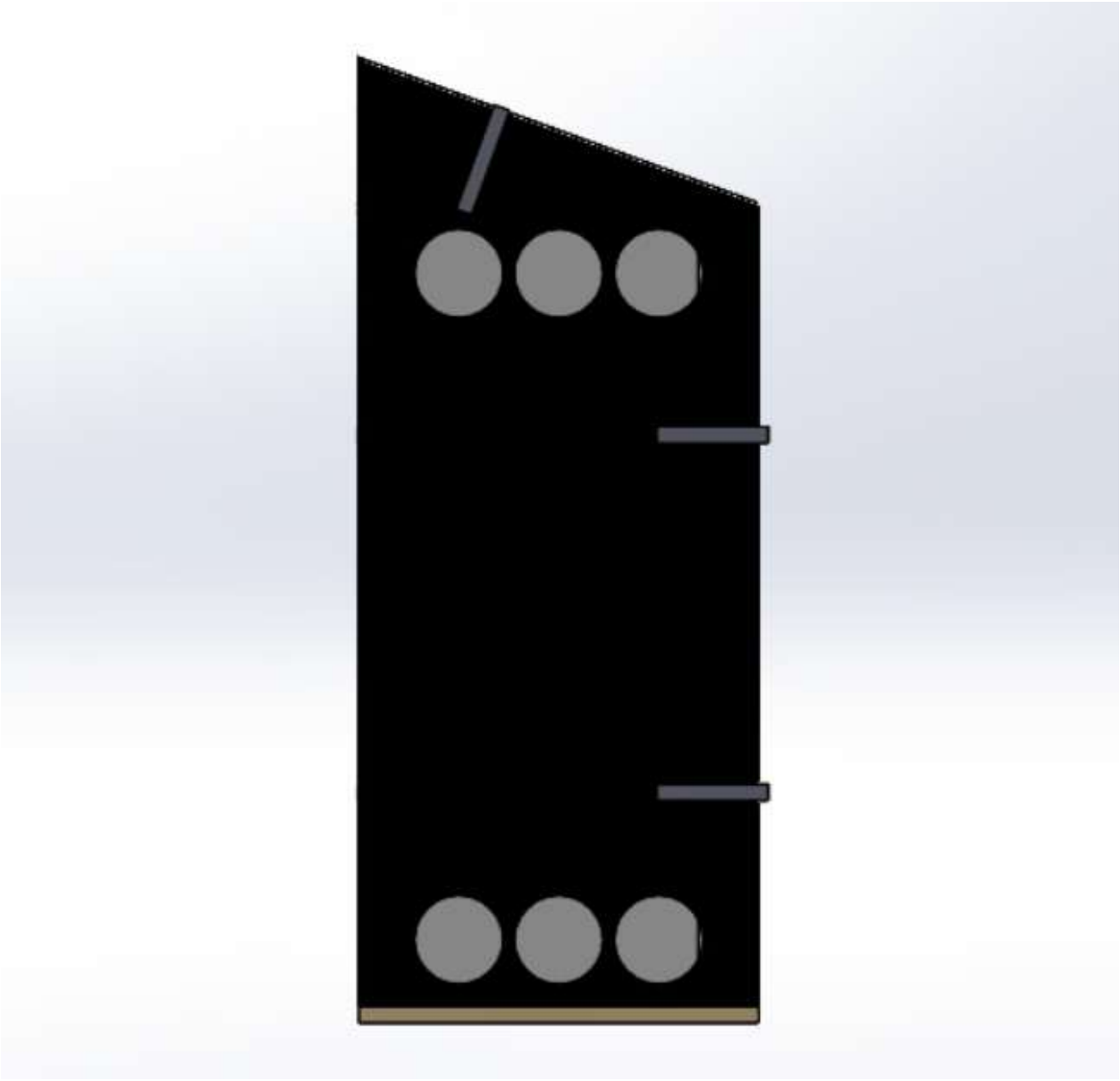
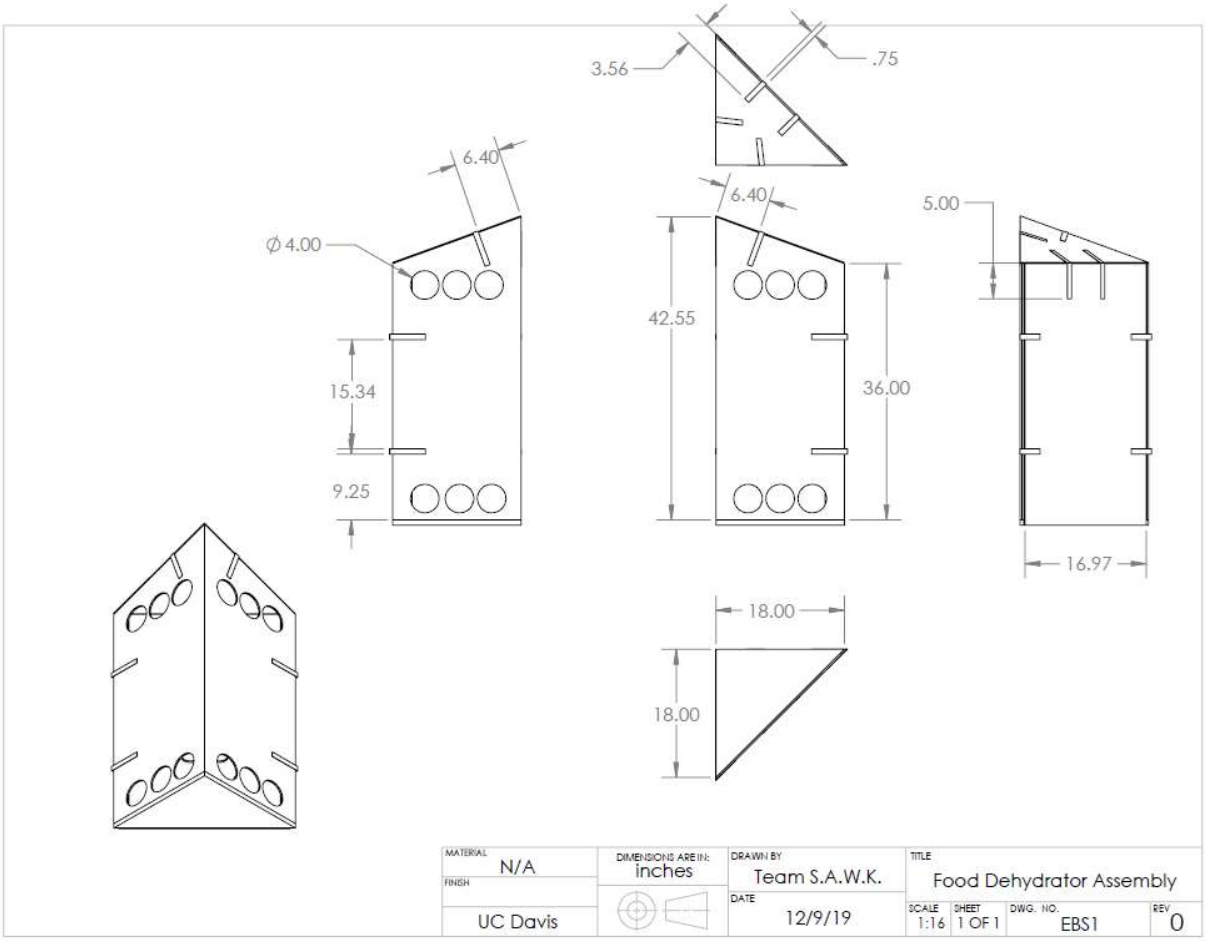
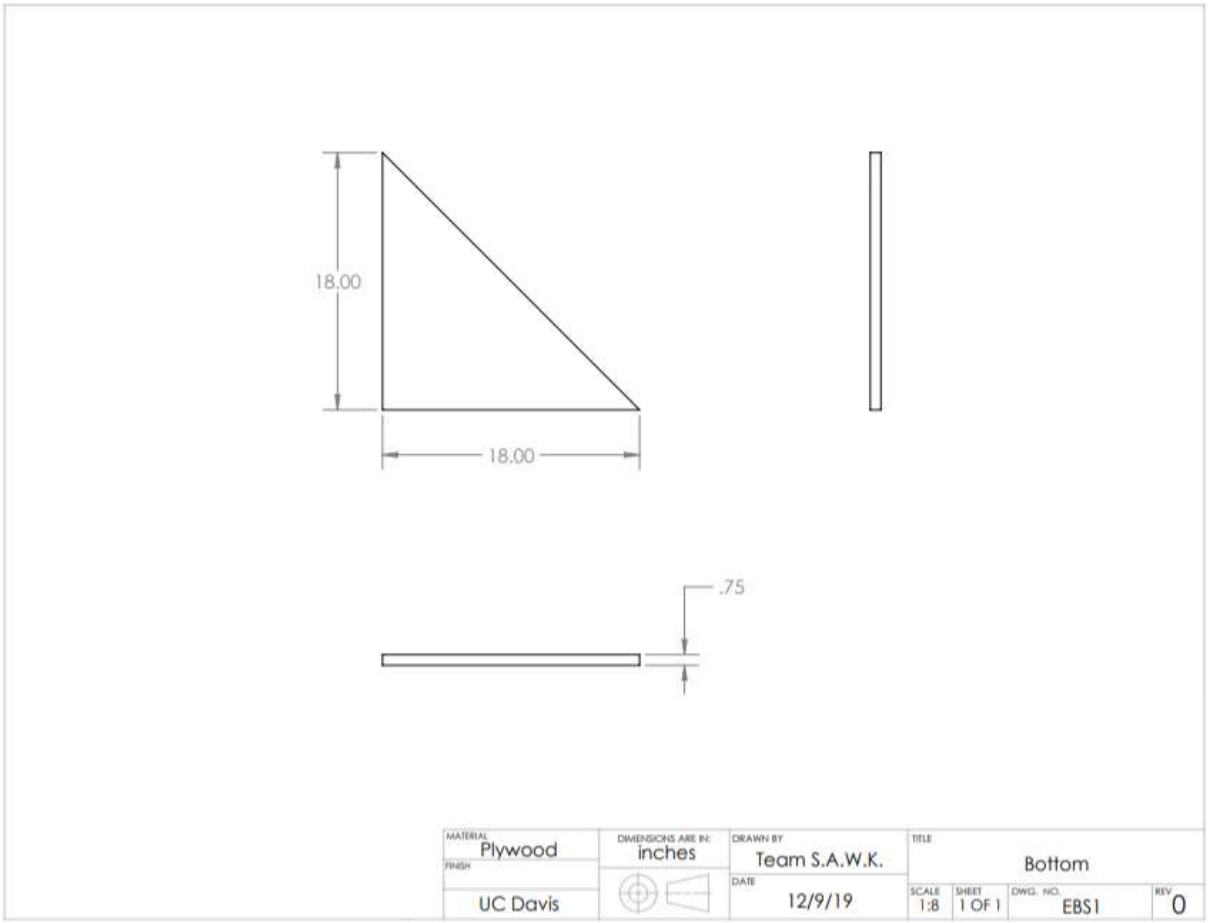


Assembly Drawing



Part Drawings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UC Davis
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Team S.A.W.K.
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12/9/19
TITLE
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1 OF 1
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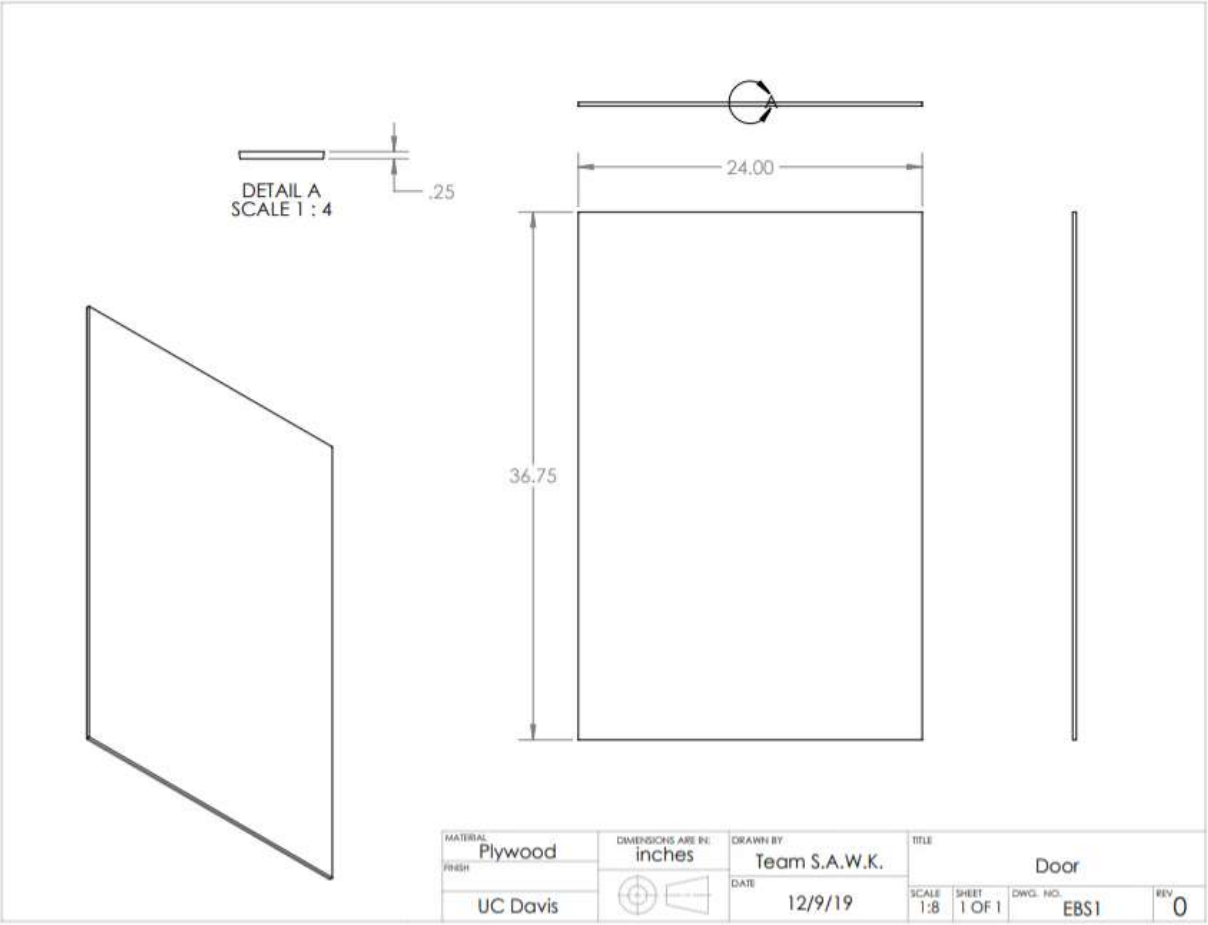
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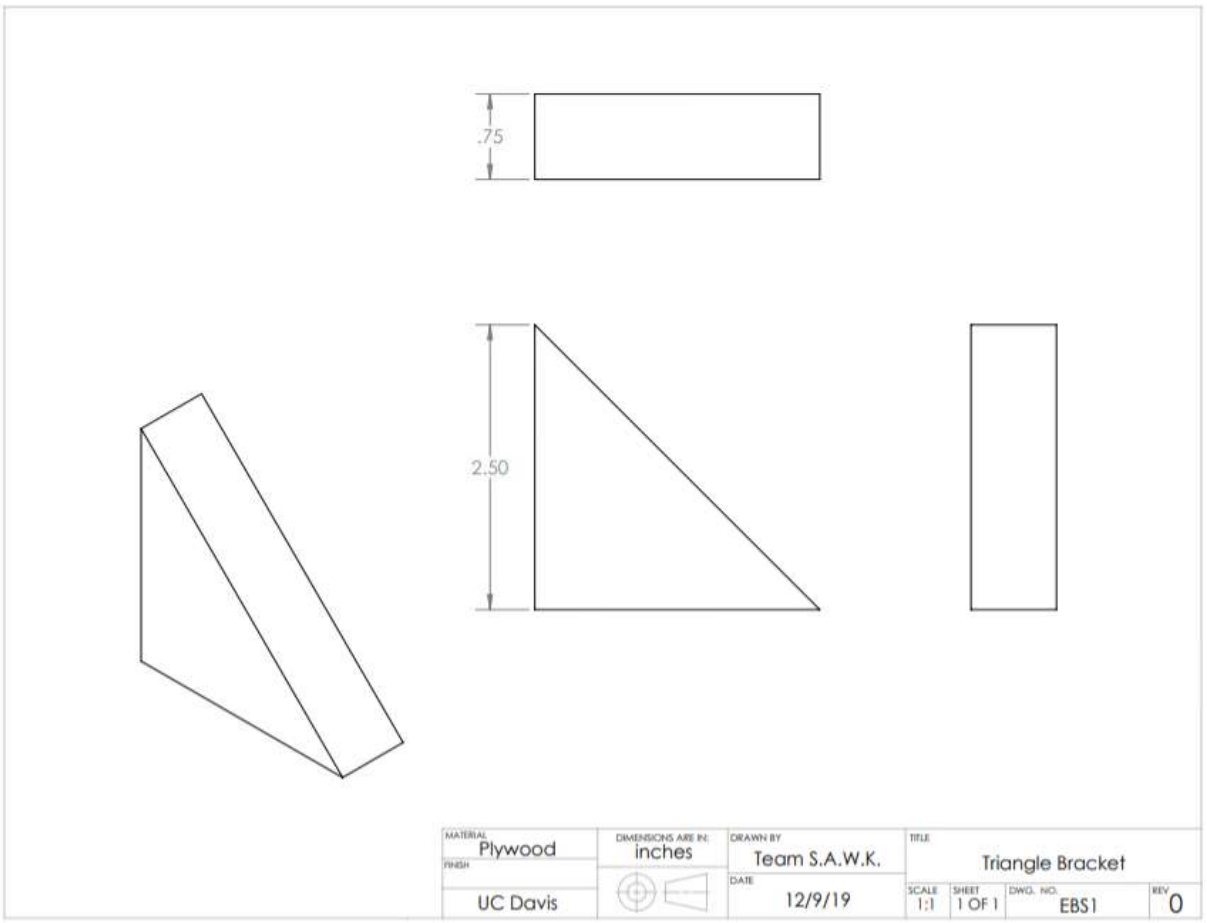
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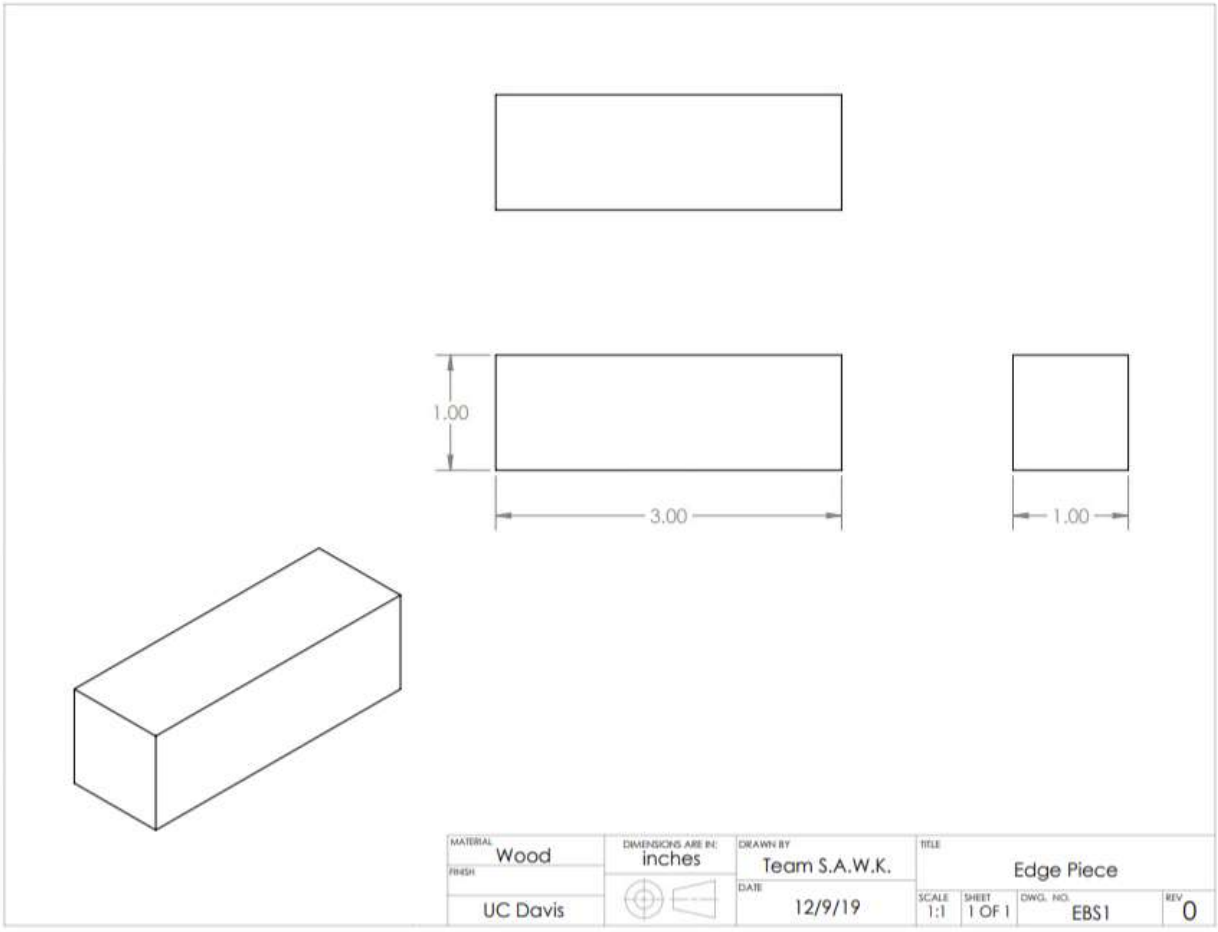
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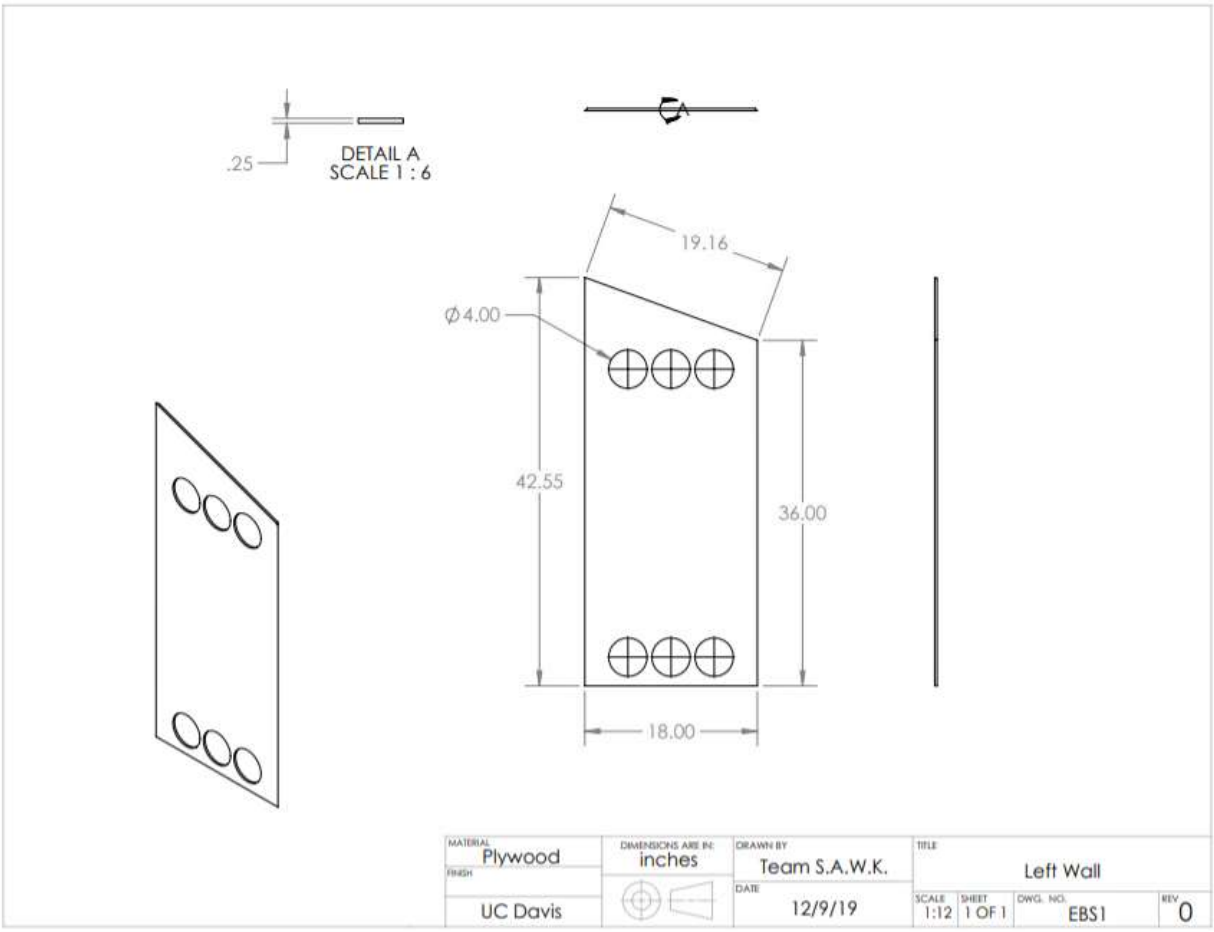
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Team S.A.W.K.
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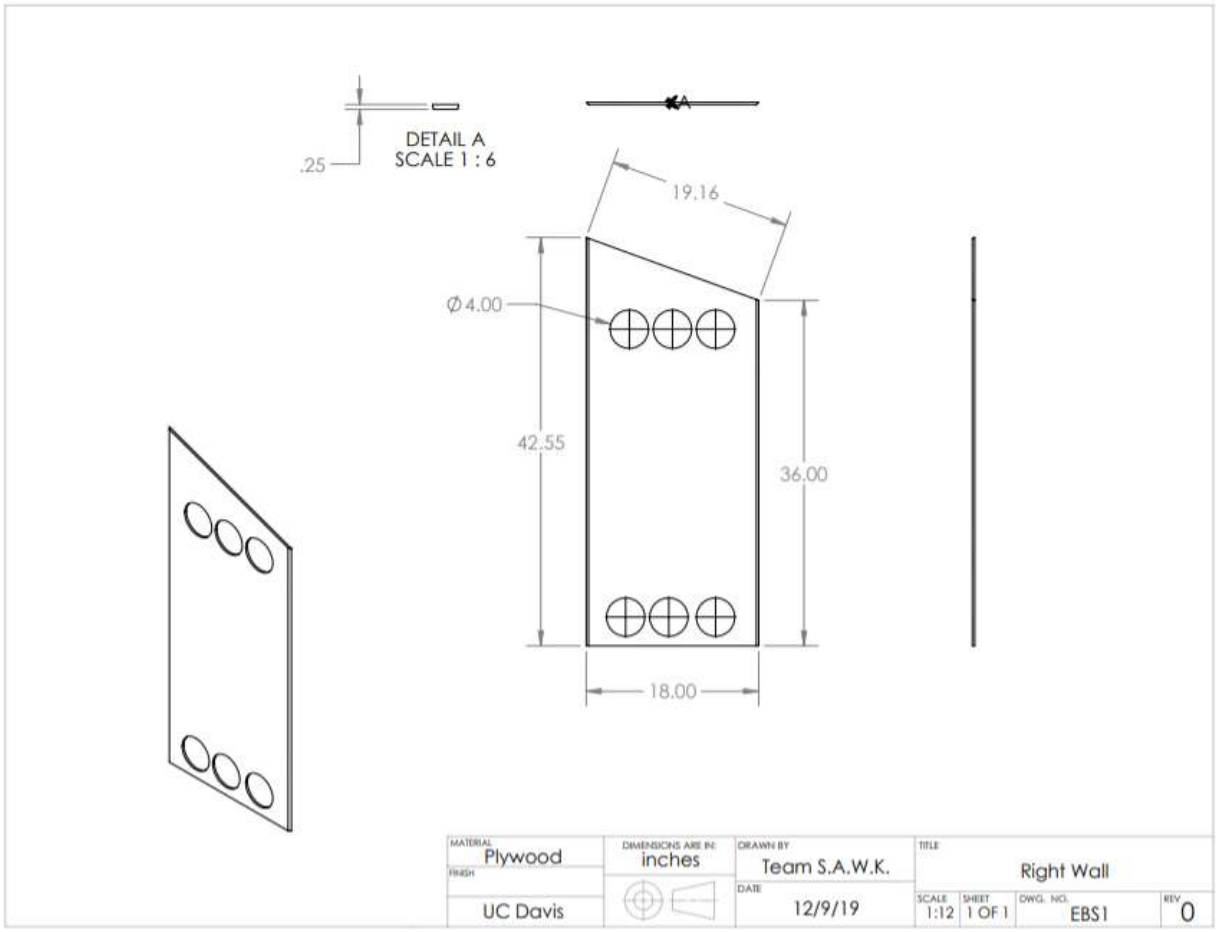
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UC Davis
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DRAWN BY
Team S.A.W.K.
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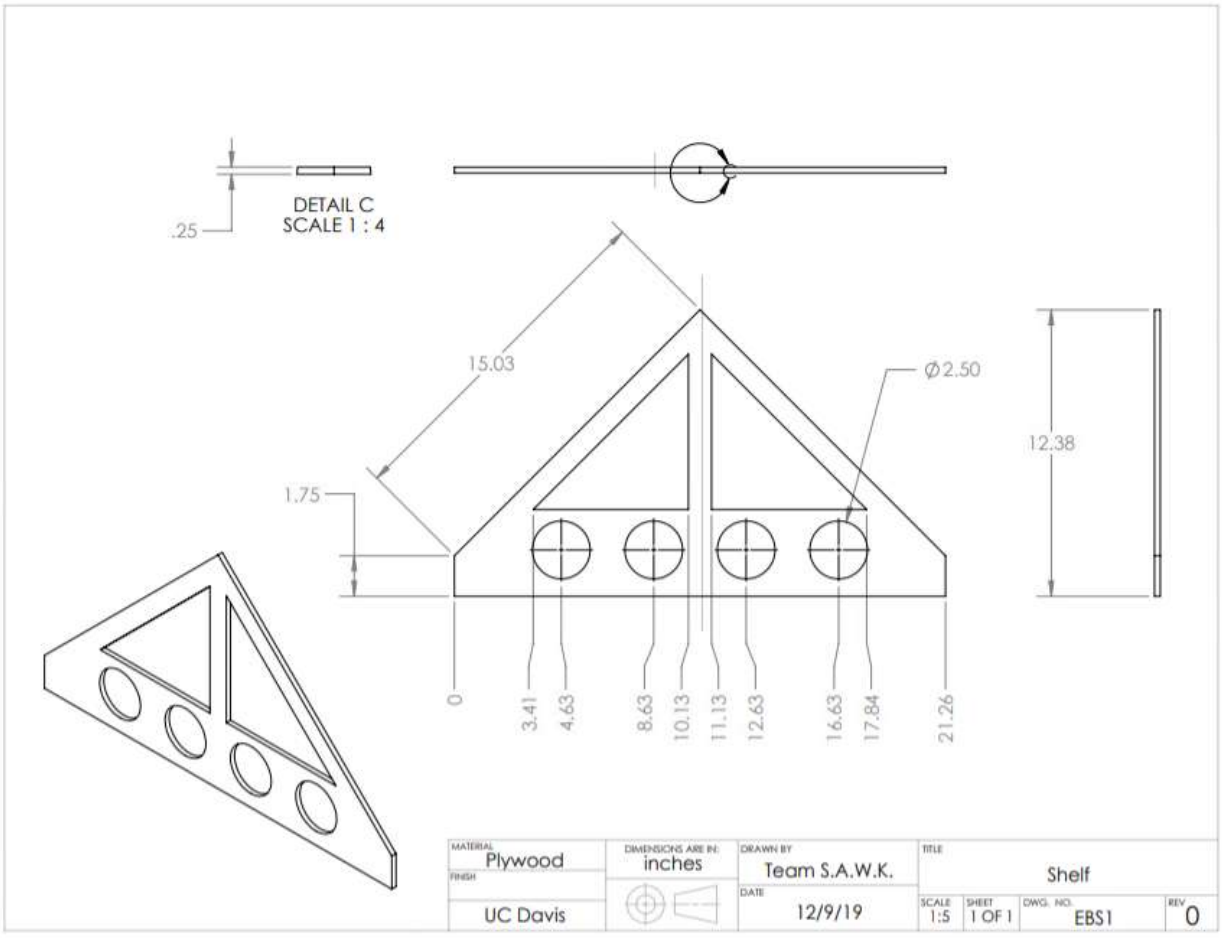
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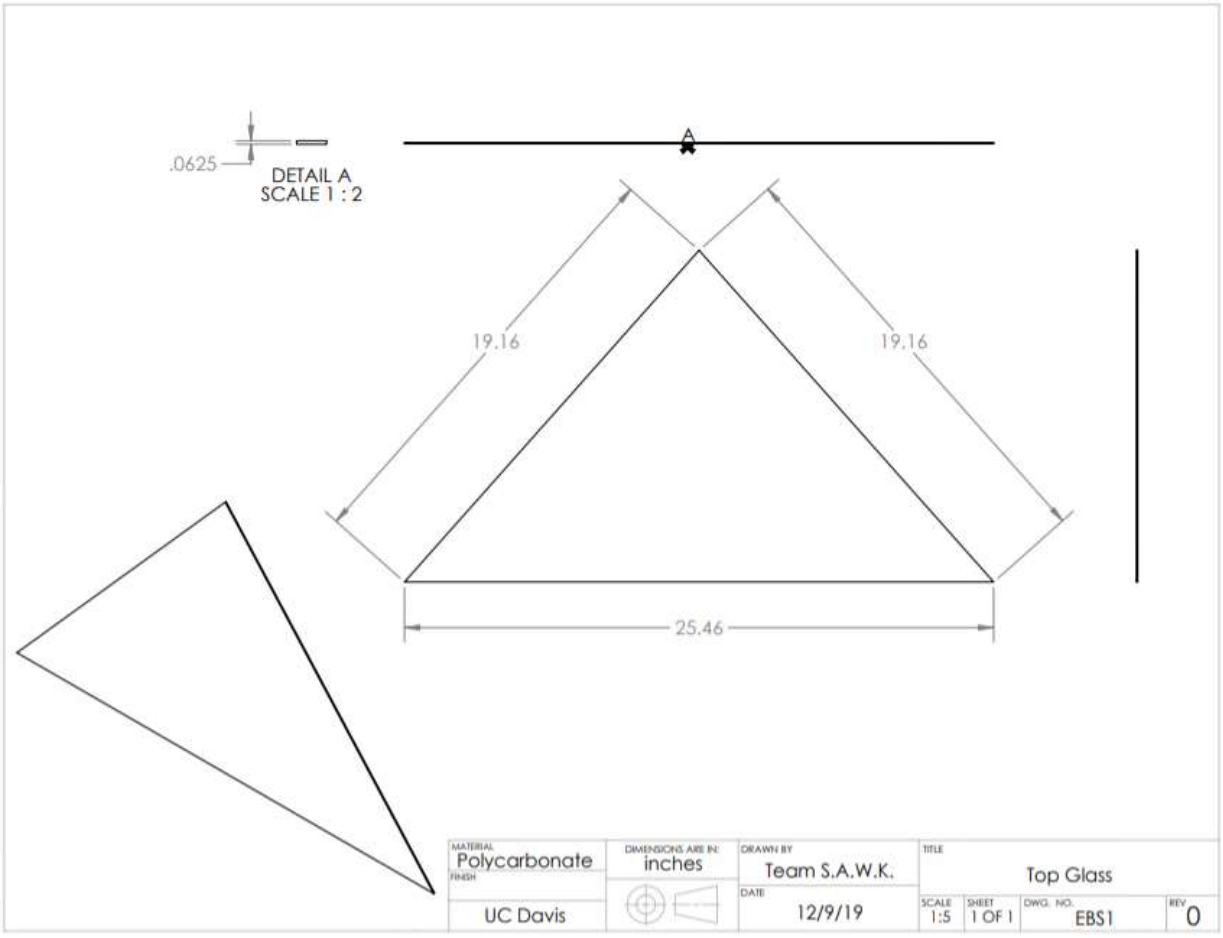
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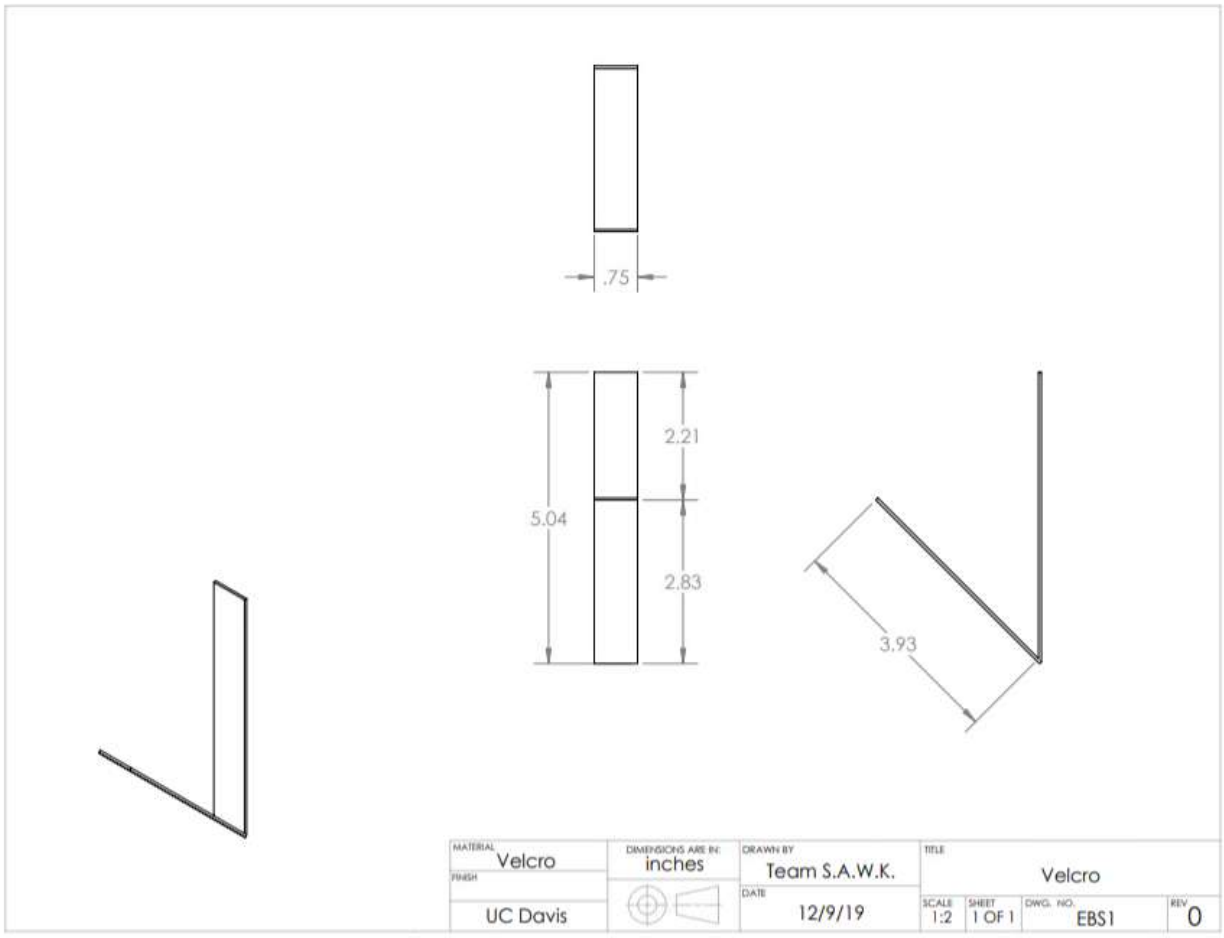
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1 OF 1
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Description of Design

A very notable feature of the design is that is triangular shaped rather than boxed which was changed due to cost issues. Having less sides would require less materials and it does not take away anything from the function of the dehydrator. Also there is a glass on top of the design slanted at 20 degrees because based off of the research conducted this will give the most proper radiation impact. Next, is that there are three holes on each side of the of the design at the top and bottom most layers to allow for airflow and they are also covered with mesh to keep bugs away. The last main thing to consider is that there are three sliding shelves that have holes on them covered with mesh in order to have air flow through the food when they are on the shelves. Having sliding shelves was included to allow for easy cleaning after use.

Fabrication

The fabrication consisted of three phases; cut individual pieces, located fasteners and make adjustments, assembly. The team initially cut all of the components to assemble the project. This step is incredibly important to complete with thoroughness and patience. The team cut one wall of the walls ¼-inch too short. The straight cuts for the walls were performed with a table saw and the 20-degree angular cut, at the top, with skill saw. The holes in the walls were cut with a 4-inch wholesaw, the original design was to use a 2-½-inch hole. The ¼-inch plywood for the door was ordered too narrow for the face of the dehydrator. The team cut a triangular runner, of 1-inch wood, to mount to both sides of the front wall to make up the difference. These runners added support to the box and considered as beneficial to the final design. All of the ¾-inch triangular, wooden wedges were cut with a bandsaw. Next were the shelves which were prepared with a 2-½-inch wholesaw and jigsaw. Cutting the triangles into the plywood with a jigsaw was challenging for the team and shelves broke. The team was able to repair this on the prototype with a staple gun. It was found that the wood must be secured well enough that as little vibration occurs so the cut is smooth. Initially, the team wanted to use tacks to hold down the different steel material to the shelves, but many tacks bent and this consumed too much time so a staple gun was used instead. Now that the parts were fabricated, fasteners were located and it was decided that it would be easier to attach the aluminum foil wire mesh to the inside prior to

assembly. Pilot holes were drilled in walls and the wedges and rails, that will hold shelves, were mounted to each wall with ¾-inch wood screws. Because the walls were equipped with the triangular wedges, it was easier to stand and mount the walls together. The runners were also a challenge to make fit properly. The top of the runner came into contact with the polycarbonate cover so they had to be ground down to let the lid fit flush. Also, because of these runners each shelf had 1-½-inches cut off both ends to fit inside the box. The polycarbonate lid was the last item to cut. It was placed on top of the box, traced and then cut with scissors. Velcro was used to hold the lid, and front door in place. Lastly, black paper was glued to the outside of the box.

Operating Conditions:

Wire Cloth	Disc
Woven Mesh	Triangular
Apple slices/ Banana Slices	~3.5 grams
Thermometer Use	◦ *F*
Scale	Grams
Height	<45 inches

We set these parameters in order to control as many variables as we could to find out whether the material itself would impact the fruits. The wire cloth and woven mesh were part of our research and that was what came to mind when we thought of testing our products since we want to know whether the airflow will impact the products dehydration more. The weight was very similar so we could see how the slices would be impacted based off one the set variable since if we have similar samples it's more likely we would get a more precise answer on whether another material would work better. We used a scale in order to find the percentage of mass change in the different fruits and it was in grams because it was the easiest way to test the weight.

Design Testing: Methods

The methods were directed towards finding the best material to dehydrate the product. We did this by taking 12 samples of apples and putting 6 on the Woven mesh and 6 on the wire cloth for 3 tests and we repeated the process for the banana. We tried to make it so the apples were similar in size shape and mass in order to see which has the most decrease in the percentage of mass loss. This test was done over a 12 hour time period where we would check the weight every 4 hours to see if the food was decreasing in mass over time. The Weather was not ideal for testing since it was raining a lot of the time, so we tried to mimic outdoor conditions by keeping the windows open, and we had a fan on low. The scale was in grams because it was the scale we were able to obtain which rounded to the tenths place.

Design Testing: Results & Analysis

Total Mass of Samples of Apple Slices from the 0 and 12th interval hours for all 3 tests

	Mesh 0	Mesh 12	Cloth 0	Cloth 12
Test 1	3.5	2.16	3.35	1.95
Test 1	3.1	1.43	3.55	1.85
Test 1	3.8	1.55	3.35	1.48
Test 1	3.6	1.92	3.54	1.84
Test 1	3.4	1.12	3.44	1.62
Test 1	3.55	1.28	3.38	1.8
Test 2	3.32	1.43	3.42	2.06
Test 2	3.35	1.69	3.6	1.84
Test 2	3.5	1.83	3.47	2.13
Test 2	3.73	1.89	3.45	2.29
Test 2	3.38	1.71	3.44	2.27
Test 2	3.52	2.05	3.6	2.6
Test 3	3.3	2.2	3.54	2.28
Test 3	3.53	2.58	3.43	2.43
Test 3	3.52	2.62	3.65	2.71
Test 3	3.43	2.25	3.55	2.28
Test 3	3.4	2.28	3.35	2.3

Test 3	3.53	2.32	3.7	2.65
Average	3.47	1.906111111	3.489444444	2.132222222
Standard Deviation	0.1601469913	0.4369834953	0.1064105381	0.3524795456

Figure 1.1

The Mesh vs Cloth mass loss % all 24 samples Apples		
	Mesh % H2O lost	Cloth % H2O lost
Test 1	38.28571429	41.79104478
Test 1	53.87096774	47.88732394
Test 1	59.21052632	55.82089552
Test 1	46.66666667	48.02259887
Test 1	67.05882353	52.90697674
Test 1	63.94366197	46.74556213
Test 2	56.92771084	39.76608187
Test 2	49.55223881	48.88888889
Test 2	47.71428571	38.6167147
Test 2	49.32975871	33.62318841
Test 2	49.40828402	34.01162791
Test 2	41.76136364	27.77777778
Test 3	33.33333333	35.59322034
Test 3	26.9121813	29.15451895
Test 3	25.56818182	25.75342466
Test 3	34.40233236	35.77464789
Test 3	32.94117647	31.34328358
Test 3	34.2776204	28.37837838
Average:	45.06471266	38.99200863
SD:	12.3823197	9.23113483

Figure 1.2

Mesh vs Cloth Average Mass loss % for the 3 tests in the Apples		
	Mesh	Cloth
AVG % moisture lost Test 1	54.83939342	48.86240033
AVG % moisture lost Test 2	49.11560696	37.11404659
AVG % moisture lost Test 3	31.23913761	30.99957897

Figure 1.3

Difference in means with a 95% confidence interval for apple slices	
Upper Bound	15.20077602
Lower Bound	-3.055367958

Figure 1.4

Total Samples of Banana Slices from the 0 and 12th hour interval for all 3 tests				
	Woven 0	Woven 12	Wire 0	Wire 12
Test 1	3.31	1.67	3.47	1.97
Test 1	3.7	1.64	3.62	2.1
Test 1	3.52	1.96	3.37	1.95
Test 1	3.14	1.51	3.78	2.29
Test 1	3.36	1.82	3.31	1.93
Test 1	3.55	1.93	3.49	2.02
Test 2	3.35	1.7	3.63	2.1
Test 2	3.33	1.7	3.5	2
Test 2	3.66	2	3.12	1.5

Test 2	3.3	1.8	3.32	2
Test 2	3.32	1.8	3.62	2.2
Test 2	3.09	1.6	3.92	2.5
Test 3	3.5	1.4	3.7	2.2
Test 3	3.7	1.4	3.7	2.4
Test 3	3.5	1.5	3.9	2.6
Test 3	3.8	1.6	3.9	2.6
Test 3	3.9	1.7	3.4	2.1
Test 3	3.9	1.8	3.9	2.7
Average	3.496111111	1.696111111	3.591666667	2.175555556
Standard Deviation	0.2419805264	0.177437276	0.2364007067	0.298825588

Figure 2.1

The Mesh vs Cloth mass loss % in the 24 Banana Slices		
	woven % H2O lost	Wire % H2O lost
Test 1	49.54682779	43.22766571
Test 1	55.67567568	41.98895028
Test 1	44.31818182	42.13649852
Test 1	51.91082803	39.41798942
Test 1	45.83333333	41.6918429
Test 1	45.63380282	42.12034384
Test 2	49.25373134	42.14876033
Test 2	48.94894895	42.85714286
Test 2	45.35519126	51.92307692
Test 2	45.45454545	39.75903614
Test 2	45.78313253	39.22651934
Test 2	48.22006472	36.2244898
Test 3	60	40.54054054
Test 3	62.16216216	35.13513514
Test 3	57.14285714	33.33333333
Test 3	57.89473684	33.33333333
Test 3	56.41025641	38.23529412

Test 3	53.84615385	30.76923077
Average:	51.29946834	39.67051018
SD:	5.720857458	4.824578259

Figure 2.2

Mesh vs Cloth Average Mass loss % for 3 Tests for the bananas		
	Mesh	Cloth
AVG % mass lost Test 1	48.81977491	41.76388178
AVG % mass lost Test 2	47.16926904	42.0231709
AVG % mass lost Test 3	57.90936107	35.22447787

Figure 2.3

Difference in means with a 95% confidence interval	
Upper Bound	16.08264215
Lower Bound	7.175274169

Figure 2.4

Difference in means with a 99% confidence interval	
Upper Bound	17.01040329
Lower Bound	6.247513029

Figure 2.5

In our data analysis we tested the percentage of mass loss in the fruit that was placed on the woven mesh and wire cloth. We did this to see whether the material would work better for either the apple or banana slices. In order to do this we had to test for a specific interval of time which was from 0 to 12 and weighed the mass. After we obtained all the data, we started to find the percentage of mass change over time by using the equation: Percent Change in Mass = Mass Difference(g) x 100% Initial Mass(g). We did this for all of the samples across each test of the slices on the woven mesh and wire cloth. Then we found the average and standard deviation of

the two percentage of mass loss followed by using the difference of means for a 95% confidence interval:

$$(\overline{X}_1 - \overline{X}_2) \pm Tcritical\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

Where $\overline{X}_1 = the\ average\ \%\ of\ mass\ loss\ in\ the\ woven\ mesh\ material$

$\overline{X}_2 = the\ average\ \%\ of\ mass\ loss\ in\ the\ wire\ cloth\ material$

$\frac{s_1^2}{n_1} = The\ variance\ divided\ by\ the\ number\ of\ samples\ of\ the\ woven\ mesh\ material$

and

$\frac{s_2^2}{n_2} = The\ variance\ divided\ by\ the\ number\ of\ samples\ of\ the\ wire\ disc\ material$

Doing this gave us the information of whether or not our averages were similar between the woven mesh and wire cloth for being 95% confident. In figure 1.4 the confidence interval shows that it goes below 0 in the interval which implies we can say we are 95% Confident that the means are the same for the apple slices. This means that the material did not result in a greater amount of mass loss over the 3 tests. We expected this because we believed in the null hypothesis which was that the material would not change how the food dehydrates. We can now see that from figure 2.4 that the banana did have a confidence interval that was not below zero this implies that the means are not the same! We did not expect this so we did a 99% confidence interval in figure 2.5 which still rejected the null hypothesis! In conclusion the banana had a better dehydration percentage in the woven mesh than the wire cloth. This is most likely because of the fact that there are greater amounts of holes in the mesh which allows for more airflow through the fruit. There may have been environmental, size, weight, and elevation levels of height that could have possibly interfered with the results, but we think that with our decent size of samples and tests we could accurately see how each material will impact the fruits.

Economic Analysis

1) The total estimated cost came up to $33.31

2)

Materials	Cost per dimension	Used	Total cost
Plywood	**48 by 96 inch is $15.05**	**2403 in^2**	**$7.68**
Polycarbonate	**48 by 48 inch is $41.54**	**182.7 in^2**	**$3.29**
Aluminum	**0.003266 per in^2**	**2241 in^2**	**$0.72**
Wired Mesh	**2 times (12 by 40 in)**	**145.8 in^2**	
Disc	**$0.26 per disc**	**113 in^2**	**$6.68**

The total cost of the project came up to 33 dollars but including the aid from the shop which added to about an hour which should add 80 dollars to the budget making it $113.

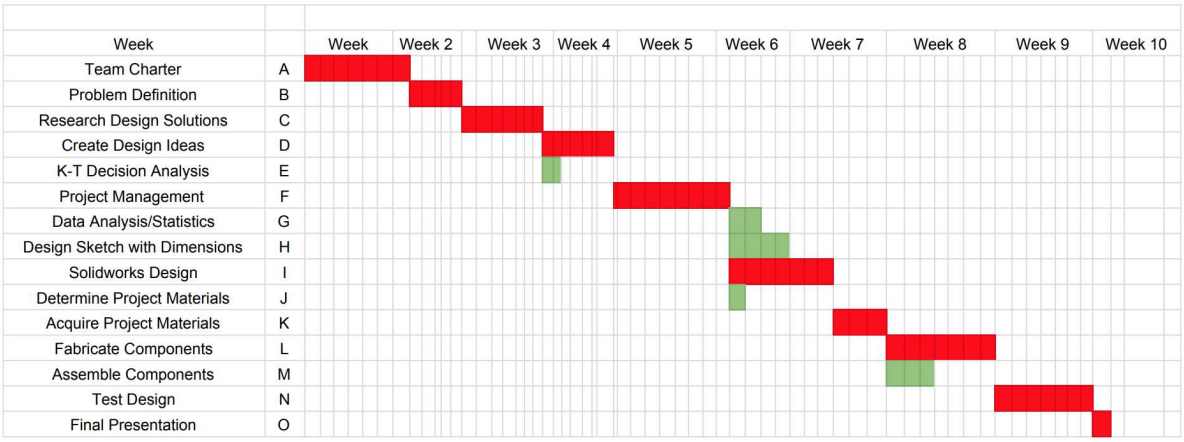
Design Manufacturing Information

The estimated cost of the project is $113. Assembly must be streamlined in order to make this project manufacturable. It has many components so the labor of assembly would be the most expensive part of this design. In order to manufacture large numbers of these, the parts would need to be cut by machinery and labor to only nail the components together.

Future Recommendations & Conclusions

The team recommends that the triangular wedges be replaced with ¾-inch square wood and that the box be assembled with a nail gun. This would be quicker and produce a better seal at the seams. The shelves should only have large triangle cut-outs and 2-½-inch ventilation holes cut in the walls. Overall the dehydrator successfully raises its internal temperature to dehydrate for and with these recommendations should streamline its assembly.

Project Management



So by following the critical path the team was able to move along the design process with no deviations. There were some moments where the type was tighter and the work had to be manage with more effort, but the design was still completed in time.

Team Norms and Statement of Individual Team Member Responsibilities

Wesley's role was to help with memo submissions/powerpoint/SolidWorks/report, sketch the possible designs, and fabrication. He attended each meeting to help with memos, added to each powerpoint, participated in discussion and planning of presentations, and contributed to the final report, particularly with fabrication/ manufacturing/recommendations. He was also responsible for the shelf in SolidWorks and completed this. After the team came up with three design alternatives, Wesley produced the sketch of the three designs. Finally, he was a part of the fabrication where he helped with each day of building and took the project home so that it could be assembled completely and ready for testing. With the data, he helped to finalize the graphs and put into the presentation.

Kevin's role was to keep up with minutes and organize when our group should meet each week. He helped with research and process designed by giving ideas based off research papers and articles. Kevin helped with the gantt chart and network diagram to find the critical path. He did not miss a single meeting, and he was very positive worker. Kevin helped with the assembly by cutting wood strips and drilling screws into the prototype. After We had assembled the prototype he put in a lot of work for the test data where he had tested the 95% confidence intervals of both the banana and apples mass loss percentage. He also analyzed all the data result

and put many hours into how we could test our prototype more. Finally, Kevin had put together all the data and present our results and conclusion in the final presentation.

Alharith's role was to help with the research process and make suggestions to the project on how to maximize the efficiency of the dehydrator. Showed up to all the meetings and helped with cutting some of the parts when it came to the fabrication. Another role Alharith had was to help out with the memos and remind everyone of the content that needs to be included for each assignment.

Steven's role was to create a design on Solidworks that would help guide the construction of the project. He also conducted tests on the dehydration of the bananas and collected data on temperature as well. In addition, he helped with the construction of the design.

References

Eswara, A.R. Ramakrishnarao, M. J(2013). Solar energy in food processing—a critical

appraisal. *Journal of Food Science and Technology*, 50(2), 209-227. https://doi.org/10.1007/s13197-012-0739-3

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MSKS. (2017). Which Metals Conduct Heat Best? https://www.metalsupermarkets.com/which-metals-conduct-heat-best/

Scanlin, D. (2014). Best-Ever Solar Dehydrator Plans https://www.motherearthnews.com/diy/tools/solar-food-dehydrator-plans-zm0z14jjzmar

Appendices

Appendix A. Meeting Minutes

Meeting 1:

CATME Meeting Support **Agenda and Minutes for [S.A.W.K]**

Instructions: Complete items in green before the meeting and circulate as the agenda. Complete items in black after the meeting and circulate as the meeting minutes.

Meeting Date and Time: 10/1/19, 10

Meeting Location: Library

Team Member Names	**Assignments Due**	**Present?**	**Prepared?**	**Comments** *(if absent, include reasons and whether teammates were notified in advance)*
Steven Tom	N/A	Yes	Yes	
Alharith Alghaithy	N/A	Yes	Yes	
Wesley Kraintz	N/A	Yes	Yes	
Kevin Medici	N/A	Yes	Yes	

Agenda Items for Discussion and/or Work to be Completed	**Expected Duration** (actual duration)	**Summary of Discussion**
1. Review minutes of last meeting.	N/A	Initial meeting
2. Discuss work completed since last meeting.	N/A	Initial meeting
3.		
4.		
5.		
6. memo 1	45	we expect a lot from our group and how to communicate.

7. Review action items to be completed after meeting.	10 min	research
8. Schedule next meeting	10 minute	Tuesdays at 10 are the best times.

Action items to be completed after meeting	**Who is responsible?**	**Due?**	**Comments**
1. Punctuality	All	Weekly	Team members are expected to meet every Tuesday at 10am for approximately 1 hour

Next Meeting

Date and Time: Tuesday 10 AM

Location: Library

Purpose: Complete memos and discuss more about project

Recording Secretary

Meeting agenda circulated on 10/1/19 by Kevin.

Meeting minutes circulated on 10/1/19 by Kevin.

Any corrections to the minutes to be submitted to Kevin by anytime.

Meeting 2:

CATME Meeting Support **Agenda and Minutes for S.A.W.K**

Instructions: Complete items in green before the meeting and circulate as the agenda. Complete items in black after the meeting and circulate as the meeting minutes.

Meeting Date and Time: [10/8/19, 10A.M.]

Meeting Location: Library

Team Member Names	**Assignments Due**	**Present?**	**Prepared?**	**Comments** *(if absent, include reasons and whether teammates were notified in advance)*
Steven Tom		Yes	Yes	
Alharith Alghaithy		Yes	Yes	
Wesley Kraintz		Yes	Yes	
Kevin Medici		Yes	Yes	

Agenda Items for Discussion and/or Work to be Completed	**Expected Duration** (actual duration)	**Summary of Discussion**
1. Review minutes of last meeting.	5 minutes	we got screwed over and have to do food dehydrator
2. Discuss work completed since last meeting.		Reviewed food dehydrator to be familiar with concept
3.		
4.		
5. Memo 2		What source of energy will we use in order to power the food dehydrator
6.		
7. Review action items to be completed after meeting.		Research food dehydrator and find the needs for it to function

8. Schedule next meeting		Next tuesday at the same time

Action items to be completed after meeting	Who is responsible?	Due?	Comments
1.Memo 3	all	10/14/19	get done?

Next Meeting

Date and Time: [10/15/19, 10A.M.]

Location: Library

Purpose: Complete MEMO 4 and start making decision using "K-T Decision Analysis"

Recording Secretary

Meeting agenda circulated on 10/8/19 by Kevin.

Meeting minutes circulated on 10/8/19 by Kevin.

Any corrections to the minutes to be submitted to Kevin by anytime.

Meeting 3:

CATME Meeting Support **Agenda and Minutes for S.A.W.K**

Instructions: Complete items in green before the meeting and circulate as the agenda. Complete items in black after the meeting and circulate as the meeting minutes.

Meeting Date and Time: 10/15/19

Meeting Location: Library

Team Member Names	**Assignments Due**	**Present?**	**Prepared?**	**Comments** *(if absent, include reasons and whether teammates were notified in advance)*
Steven Tom		Yes	Yes	late because didn't know how to use his bike lock lol
Alharith Alghaithy		Yes	Yes	
Wesley Kraintz		Yes	Yes	
Kevin Medici		Yes	Yes	

Agenda Items for Discussion and/or Work to be Completed	**Expected Duration** (actual duration)	**Summary of Discussion**
1. Review minutes of last meeting.	10 minutes	found energy source have rough idea of what we want to do.
2. Discuss work completed since last meeting.	10 minutes	We did well to finish memo 3
3. memo 4	30 minutes	draw
4. discussion of project details	15 minutes	

6. Review action items to be completed after meeting.	10 minutes	
7. Schedule next meeting	N/A	

Action items to be completed after meeting	Who is responsible?	Due?	Comments
1.Table	Steven Tom	Saturday for all	
2. Summary/concise details	Alharith Alghaithy		
3. Sketchs	Wesley Kraintz		
4. Cost for material/ concise statement	Kevin Medici		
5.			

Next Meeting

Date and Time: 10/22/19; 10-11:30

Location: kearney hall tercero

Purpose: Get next memo done and discuss more on project details

Recording Secretary

Meeting agenda circulated on 10//19 by Kevin.

Meeting minutes circulated on 10/15/19 by Kevin.

Any corrections to the minutes to be submitted to Kevin by anytime.

Meeting 4:

CATME Meeting Support

Agenda and Minutes for S.A.W.K

Instructions: Complete items in green before the meeting and circulate as the agenda. Complete items in black after the meeting and circulate as the meeting minutes.

Meeting Date and Time: 10/15/19

Meeting Location: Library

Team Member Names	Assignments Due	Present?	Prepared?	Comments *(if absent, include reasons and whether teammates were notified in advance)*
Steven Tom		Yes	Yes	late because didn't know how to use his bike lock lol
Alharith Alghaithy		Yes	Yes	
Wesley Kraintz		Yes	Yes	
Kevin Medici		Yes	Yes	

Agenda Items for Discussion and/or Work to be Completed	Expected Duration (actual duration)	Summary of Discussion
1. Review minutes of last meeting.	10 minutes	found energy source have rough idea of what we want to do.
2. Discuss work completed since last meeting.	10 minutes	We did well to finish memo 3
3. memo 4	30 minutes	draw
4. discussion of project details	15 minutes	
5.		
6. [item added during meeting]		

7. Review action items to be completed after meeting.	10 minutes	
8. Schedule next meeting	N/A	

Action items to be completed after meeting	**Who is responsible?**	**Due?**	**Comments**
1.Table	Steven Tom	Saturday for all	
2. Summary/concise details	Alharith Alghaithy		
3. Sketchs	Wesley Kraintz		
4. Cost for material/ concise statement	Kevin Medici		
5.			

Next Meeting

Date and Time: 10/22/19; 10-11:30

Location: kearney hall tercero

Purpose: Get next memo done and discuss more on project details

Recording Secretary

Meeting agenda circulated on 10//19 by Kevin.

Meeting minutes circulated on 10/15/19 by Kevin.

Any corrections to the minutes to be submitted to Kevin by [date].

Meeting 5:

CATME Meeting Support **Agenda and Minutes for S.A.W.K**

Instructions: Complete items in green before the meeting and circulate as the agenda. Complete items in black after the meeting and circulate as the meeting minutes.

Meeting Date and Time: 10/24; 3-4:30

Meeting Location: Kearny

Team Member Names	**Assignments Due**	**Present?**	**Prepared?**	**Comments** *(if absent, include reasons and whether teammates were notified in advance)*
Steven Tom	1.gannt chart	yes	yes	
Alharith Alghaithy	2.work breakdown	yes	yes	
Wesley Kraintz	3.network diagram	yes	yes	
Kevin Medici	4. work breakdown	yes	yes	

Agenda Items for Discussion and/or Work to be Completed	**Expected Duration** (actual duration)	**Summary of Discussion**
1. Review minutes of last meeting.	10	have to understand the work breakdown
2. Discuss work completed since last meeting.	0	none
3. studying	30	
4.		
5.		
6.		
7. Review action items to be completed after meeting.		

8. Schedule next meeting		

Action items to be completed after meeting	Who is responsible?	Due?	Comments
1.			
2.			
3.			
4.			
5.			

Next Meeting

Date and Time: 10/24/19

Location: Kearny

Purpose: Get the WBS, Gantt chart and network diagram done

Recording Secretary

Meeting agenda circulated on 10/24 by Kevin.

Meeting minutes circulated on 10/24 by Kevin.

Any corrections to the minutes to be submitted to Kevin by 10/24.

Meeting 6:

CATME Meeting Support

Agenda and Minutes for S.A.W.K

Instructions: Complete items in green before the meeting and circulate as the agenda. Complete items in black after the meeting and circulate as the meeting minutes.

Meeting Date and Time:10/22/19 10:05-11:30

Meeting Location: Kearny

Team Member Names	**Assignments Due**	**Present?**	**Prepared?**	**Comments** *(if absent, include reasons and whether teammates were notified in advance)*
Steven Tom	1.gannt chart	yes	yes	
Alharith Alghaithy	2.work breakdown	yes	yes	
Wesley Kraintz	3.network diagram	yes	yes	
Kevin Medici	4. work breakdown	yes	yes	

Agenda Items for Discussion and/or Work to be Completed	**Expected Duration** (actual duration) minutes	**Summary of Discussion**
1. Review minutes of last meeting.	10	studied understood gantt and wbs
2. Discuss work completed since last meeting.	none	
3. resubmit memo 3	5	
4.figure out WBS	60	
5. Gantt Chart	10	
6. Network diagram	10	

7. Review action items to be completed after meeting.	5	
8. Schedule next meeting	5	

Action items to be completed after meeting	Who is responsible?	Due?	Comments
1.			
2.			
3.			
4.			
5.			

Next Meeting

Date and Time: 11/5/19 10-11:30

Location:kearny

Purpose: get next memo done

Recording Secretary

Meeting agenda circulated on 10/22/19 by Kevin.

Meeting minutes circulated on 10/22/19 by Kevin.

Any corrections to the minutes to be submitted to Kevin by anytime.

Meeting 7:

CATME Meeting Support **Agenda and Minutes for S.A.W.K**

Instructions: Complete items in green before the meeting and circulate as the agenda. Complete items in black after the meeting and circulate as the meeting minutes.

Meeting Date and Time: 11/12/19 10:10

Meeting Location:Bainer Hall

Team Member Names	**Assignments Due**	**Present?**	**Prepared?**	**Comments** *(if absent, include reasons and whether teammates were notified in advance)*
Steven Tom	N/A	No	No	No text, call, or excuse.
Alharith Alghaithy	N/A	yes	yes	
Wesley Kraintz	N/A	yes	yes	
Kevin Medici	N/A	yes	yes	

Agenda Items for Discussion and/or Work to be Completed	**Expected Duration** (actual duration)	**Summary of Discussion**
1. Review minutes of last meeting.	10	Talked about getting materials and doing memo 6
2. Discuss work completed since last meeting.	5	We have the steel mesh, and we are talking to jediah about getting more materials
3.		
4. Deadline for project	10	get done with prototype by november 25th so we can have a 2 week time frame for testing and completing the lab report.
5. working on memo 6	1 hour	We will measure the temperature and mass.

6.		
7. Review action items to be completed after meeting.	5	were getting memo done
8. Schedule next meeting	1	thursday

Action items to be completed after meeting	**Who is responsible?**	**Due?**	**Comments**
1. memo 6 temperature test plan and evaluation	Kevin	11/12	
2. Memo 6 Mass test plan and evaluation	Al	11/12	
3. drawing for rough draft of solidworks dehyrator	Wesley	before 11/19	
4. summary of memo and specifics	Steven	11/12	Steven will also check over all the work to make sure it follows the rubric
5.			

Next Meeting

Date and Time: 10/14/19 2:10

Location: Bainer hall

Purpose: start working on the project

Recording Secretary

Meeting agenda circulated on 11/14/19 by Kevin Medici.

Meeting minutes circulated on 11/14/19 by Kevin Medici.

Any corrections to the minutes to be submitted to Kevin medici by any day.

Meeting 8:

CATME Meeting Support **Agenda and Minutes for S.A.W.K**

Instructions: Complete items in green before the meeting and circulate as the agenda. Complete items in black after the meeting and circulate as the meeting minutes.

Meeting Date and Time: 11/14/19 2:10-3:30

Meeting Location:Bainer Hall breakroom

Team Member Names	**Assignments Due**	**Present?**	**Prepared?**	**Comments** *(if absent, include reasons and whether teammates were notified in advance)*
Kevin	Memo piece	yes	yes	
Steven	memo piece	yes	yes	
Al	memo piece	yes	yes	
Wesley	rough draft for solidworks	No	no	He had a big midterm and he needs rest

Agenda Items for Discussion and/or Work to be Completed	**Expected Duration** (actual duration)	**Summary of Discussion**
1. Review minutes of last meeting.	1	we did the memo and understood what were testing.
2. Discuss work completed since last meeting.	1	We have the dehydrator sketch wesley did well
3. Solid works for project	40	
4. Lab report	40	
5.		
6.		
7. Review action items to be completed after meeting.	5	

8. Schedule next meeting	5	

Action items to be completed after meeting	Who is responsible?	Due?	Comments
1.solidworks logo	all	before thurs	
2.			
3.			
4.			
5.			

Next Meeting

Date and Time: 11/19/19 10-11:30

Location: Bainer Hall

Purpose: Start prototype

Recording Secretary

Meeting agenda circulated on 11/14/19 by Kevin.

Meeting minutes circulated on 11/14/19 by Kevin.

Any corrections to the minutes to be submitted to Kevin by whenever.

Meeting 9:

CATME Meeting Support **Agenda and Minutes for S.A.W.K**

Instructions: Complete items in green before the meeting and circulate as the agenda. Complete items in black after the meeting and circulate as the meeting minutes.

Meeting Date and Time: 10-11:30

Meeting Location:Bainer Hall

Team Member Names	**Assignments Due**	**Present?**	**Prepared?**	**Comments** *(if absent, include reasons and whether teammates were notified in advance)*
Kevin	N/A	yes	yes	
Steven	N/A	yes	yes	
Al	N/A	yes	yes	
Wesley	N/A	yes	yes	

Agenda Items for Discussion and/or Work to be Completed	**Expected Duration** (actual duration)	**Summary of Discussion**
1. Review minutes of last meeting.	1	Understand solid works, we gotta do our logo
2. Discuss work completed since last meeting.	5	Got parts now, we're getting closer to done with solidworks design
3.		
4.		
5. Work on Project	1 hour	we got the wood cut out and we'll use velcro to attach the shell
6		
7. Review action items to be completed after meeting.	5	Logo for next lab, Solidworks for actual prototype

8. Schedule next meeting	1	

Action items to be completed after meeting	Who is responsible?	Due?	Comments
1.logo	All	before lab	
2.			
3.			
4.			
5.			

Next Meeting

Date and Time: 11/21/19, 2-4

Location:Bainer Hall

Purpose: Continue prototype

Recording Secretary

Meeting agenda circulated on 11/19/19 by kevin.

Meeting minutes circulated on 11/19 by Kevin.

Any corrections to the minutes to be submitted to Kevin by anyone.

Meeting 10:

CATME Meeting Support **Agenda and Minutes for S.A.W.K**

Instructions: Complete items in green before the meeting and circulate as the agenda. Complete items in black after the meeting and circulate as the meeting minutes.

Meeting Date and Time:12/3/19 10:15-11:30; 2-4

Meeting Location: Bainer

Team Member Names	**Assignments Due**	**Present?**	**Prepared?**	**Comments** *(if absent, include reasons and whether teammates were notified in advance)*
Kevin		yes	yes	
Steven		yes	yes	
Al		yes	yes	
Wesley		No	no	came a bit late that ok

Agenda Items for Discussion and/or Work to be Completed	**Expected Duration** (actual duration)	**Summary of Discussion**
1. Review minutes of last meeting.	5	We have been going at it. need to complete memo 6
2. Discuss work completed since last meeting.	5	got the holes cut out and the parts are ready to assemble
3. work on project	1:30	started screwing things in.
4.		
5		
we should be done before thanksgiving and start testing right away		

7. Review action items to be completed after meeting.	5	assembly
8. Schedule next meeting	5	

Action items to be completed after meeting	Who is responsible?	Due?	Comments
1.solidworks	all	6th for all	
2. lab report	all		
3. assembly	all		
4.data	all		
5.			

Next Meeting

Date and Time: TBD

Location:TBD

Purpose: assemble

Recording Secretary

Meeting agenda circulated on 12/3/19 by [team-member name].

Meeting minutes circulated on 12/3/19 by [team-member name].

Any corrections to the minutes to be submitted to [team-member name] by [date].

Meeting 11:

CATME Meeting Support **Agenda and Minutes for S.A.W.K**

Instructions: Complete items in green before the meeting and circulate as the agenda. Complete items in black after the meeting and circulate as the meeting minutes.

Meeting Date and Time: 12/3/19 10-11:30

Meeting Location: Phi delt house

Team Member Names	**Assignments Due**	**Present?**	**Prepared?**	**Comments** *(if absent, include reasons and whether teammates were notified in advance)*
Kevin		yes	yes	
Steven		yes	yes	
Al		yes	yes	
Wesley		Yes	yes	

Agenda Items for Discussion and/or Work to be Completed	**Expected Duration** (actual duration)	**Summary of Discussion**
1. Review minutes of last meeting.	5 min	good progress
2. Discuss work completed since last meeting.	5 min	got the testing done for apple. got the data
3.		
4.		
5. work on presentation	1 hr	be calm collective. steven's got intro, al has research, wesley has prototype design, Kevin has data analysis
6. [item added during meeting]		

7. Review action items to be completed after meeting.	10	test banana and get lab report done. This is the end we must complete all
8. Schedule next meeting	5	saturday 12/8/19 2 pm phi delt house

Action items to be completed after meeting	**Who is responsible?**	**Due?**	**Comments**
1.solidworks	all	6th for all	
2. lab report	all		
3.data	all		
5.			

Next Meeting

Date and Time: 12/8/19

Location: phi delt house

Purpose: presentation and reflect complete anything that hasn't been completed

Recording Secretary

Meeting agenda circulated on 12/3/19 by Kevin.

Meeting minutes circulated on 12/3/19 by Kevin.

Any corrections to the minutes to be submitted to Kevin by anytime.

Meeting 12:

CATME Meeting Support **Agenda and Minutes for S.A.W.K**

Instructions: Complete items in green before the meeting and circulate as the agenda. Complete items in black after the meeting and circulate as the meeting minutes.

Meeting Date and Time: 11/8/19 3:30-5

Meeting Location: Phi delt house

Team Member Names	**Assignments Due**	**Present?**	**Prepared?**	**Comments** *(if absent, include reasons and whether teammates were notified in advance)*
Kevin		yes	yes	
Steven		yes	yes	
Al		yes	yes	
Wesley		yes	yes	

Agenda Items for Discussion and/or Work to be Completed	**Expected Duration** (actual duration)	**Summary of Discussion**
1. Review minutes of last meeting.	5	we worked on our presentation
2. Discuss work completed since last meeting.	5	did well on presentation. can't studder or same um. still working on solidworks and lab report.
3.		
4.		
5. working on presentation	1 hr	coming
6.		
7. Review action items to be completed after meeting.	5 min	

8. Schedule next meeting	5 seconds	

Action items to be completed after meeting	Who is responsible?	Due?	Comments
1. solidworks drawing on lab report	Steven	12 tmrw for all	
2. description of design	Wesley		
3. data analysis of lab report and operations of condition	Kevin		
4. fixing up researchx	Al		
5.			

Next Meeting

Date and Time: 12/9/19 3:00

Location: bainer 1329

Purpose: get our presentation done

Recording Secretary

Meeting agenda circulated on 12/8/19 by Kevin.

Meeting minutes circulated on 12/8/19 by Kevin.

Any corrections to the minutes to be submitted to Kevin by tomorrow.

Appendix B. Preliminary Memos

Memo #1:

CATME Meeting Support **Team Charter for**

S.A.W.K. - Team #1 (001)

Team Member Names	Contact Information (e-mail, cell, Facebook, etc.)	Preferred Contact Method / Limitations (ex. no calls after…)
Steven Tom	sltom@ucdavis.edu (415)987-8731	Text/Email
Alharith Alghaithy	aalghaithy@ucdavis.edu, (661)800-8151	Text/Email
Wesley Kraintz	wpkraintz@ucdavis.edu (530) 530-3837400	Text/Email
Kevin Medici	kemedici@ucdavis.edu, (760) 529-1716	Text/Email

Team Member Names	Strengths related to teamwork and the team's assigned task.	Weaknesses related to teamwork and the team's assigned task.
Steven Tom	Communication, Design, Construction, Research, Fusion 360 (CAD software similar to SolidWorks)	No field experience, programming
Alharith Alghaithy	Communication, Design	Programming, no field experience
Wesley Kraintz	Design, fabrication, brainstorm, research, communication, MatLab, field experience, tools within the shop	Experience with SolidWorks
Kevin Medici	Communication, design, mat lab, brainstorming, hard working, reliable	solidworks, no field experience, time management.

1. What are your team's goals for the collaboration?

These should relate to the team's performance on the project as well as the processes that the team will follow to complete the project. What are your team's expectations regarding the quality and timeliness of the team's work?

We will stay on task about our responsibilities and expectations from the project. We should use our time as effectively as possible in order to do the best for our work. We need to have good communications on what we are doing and how we need to do it.

2. Who is responsible for each activity? What roles will each member have?

Don't forget to include logistical tasks, such as arranging meetings, preparing agendas and meeting minutes, and team process roles, such as questioning (devil's advocate), ensuring that everyone's opinion is heard, etc.

Roles for each team member are subject to change. If a team member feels overburdened by a task they are assigned, they can ask another team member for assistance.

Steven Tom: SolidWorks design, build/fabrication, minutes
Alharith Alghaithy: Supplement design with research, minutes
Wesley Kraintz: Basic design, build and fabrication, minutes
Kevin Medici: Managing meeting, writing the agendas, supplement design with research, minutes

3. What is your timetable for activities?

(Due dates, meetings, milestones, deliverables from individuals, if appropriate)

Week	Completion of Project	Objective
1	N/A	N/A
2	Team Intro	• Introduction • Timeline • Divide research • Complete 1st Memo
3	Design	• Decide target algae • Decide on materials for build • Basic design using SolidWorks
4	Design/Build	• Finalize design • Order parts • Begin build

5	Build	• Build
6	Build	• Build
7	Build/Preliminary Testing	• Test project
8	Test/Modifications	• Test/Measure effectiveness of project • Finalize any reports
9	Test/Modifications	• Test/Measure effectiveness of project • Finalize any reports
10	Create Presentation	• Develop Powerpoint Presentation
11	Practice Presentation	• Prepare and practice group presentation
12	Project Presentation	• Present project

4. What are your team's expectations regarding meeting attendance (being on time, leaving early, missing meetings, etc.)?

Attendance is mandatory for Tuesday meetings. If a member is unable to make it to a meeting, that member is expected to notify the team as soon as possible. Meetings were chosen so that they do not conflict with class schedules, so there is no reason for tardiness. More than 20 minutes late will count as an absence. An alternative to situations where all members cannot meet would be using Discord to have a voice call and have the meeting.

5. What constitutes an acceptable excuse for missing a meeting or a deadline? What types of excuses will not be considered acceptable?

Acceptable: Sickness, Family Emergency, Unforeseen issues with design/construction-(Deadlines), transportation issues(ex:flat tire), medical appointment

Not Acceptable: Need to study for a test, date with a significant other, forgetful, lazy/tired

6. What process will team members follow if they have an emergency and cannot attend a team meeting or complete their individual work promised to the team (deliverable)?

The member with the emergency will notify the team as soon as they know and can communicate. The other members will split up the work so that the team does not get behind schedule. If the work cannot be split up, then one member can complete the work.

7. What are your team's expectations regarding the quality of team members' preparation for team meetings and the quality of the deliverables that members bring to the team?

Team members must come prepared to work and do as much as possible to deliver. Do whatever you possibly can to do the best you can. In order to achieve these goals, we expect that each member will supplement their decisions and contributions with sound reason. The deliverables are expected to appear as if legitimate efforts were made.

8. What are your team's expectations regarding team members' ideas, interactions with the team, cooperation, attitudes, and anything else regarding team-member contributions?

Everyone's ideas should be heard and respected so that a wide variety of ideas can be considered before making a decision. Team members should cooperate with one another and settle disagreements with logic, not emotion. Keeping a positive attitude toward one another and the project is essential in seeing the project through. Members will never talk down to other members. This is meant to be a positive, educational experience and we all agree to uphold that idea.

9. What methods will be used to keep the team on track?

How will your team ensure that members contribute as expected to the team and that the team performs as expected? How will your team reward members who do well and manage members whose performance is below expectations?

Members should communicate with one another and reflect on Tuesday meetings to keep the team on track. Texting one another to give reminders of each others' tasks will also help keep members on track. We will rate the work of our peers on

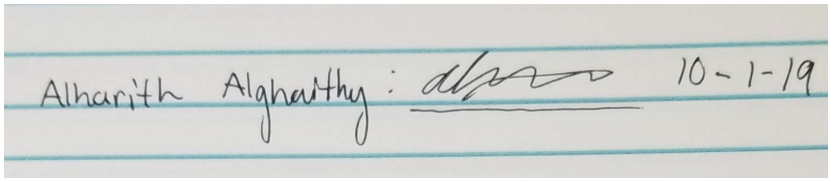
CATME; with a good work ethic will come a good evaluation. The completion of the project is its own reward as we all strive to get a good grade and gain knowledge.

Signatures:

Steven Tom: 10-1-19

Kevin Medici 10-1-19

WESLEY KRAINTZ: 10-1-19



Memo #2:

TO: Professors: Bornhorst, Mullin, Roach, Jenkins

TAs**:** Lucy Knowles, Nico Buxbaum

FROM: Team #A01 S.A.W.K: Steven Tom, Alharith Alghaithy, Wesley Kraintz, Kevin Medici

DATE: 10/09/19

SUBJECT: Problem Definition

(SUMMARY)

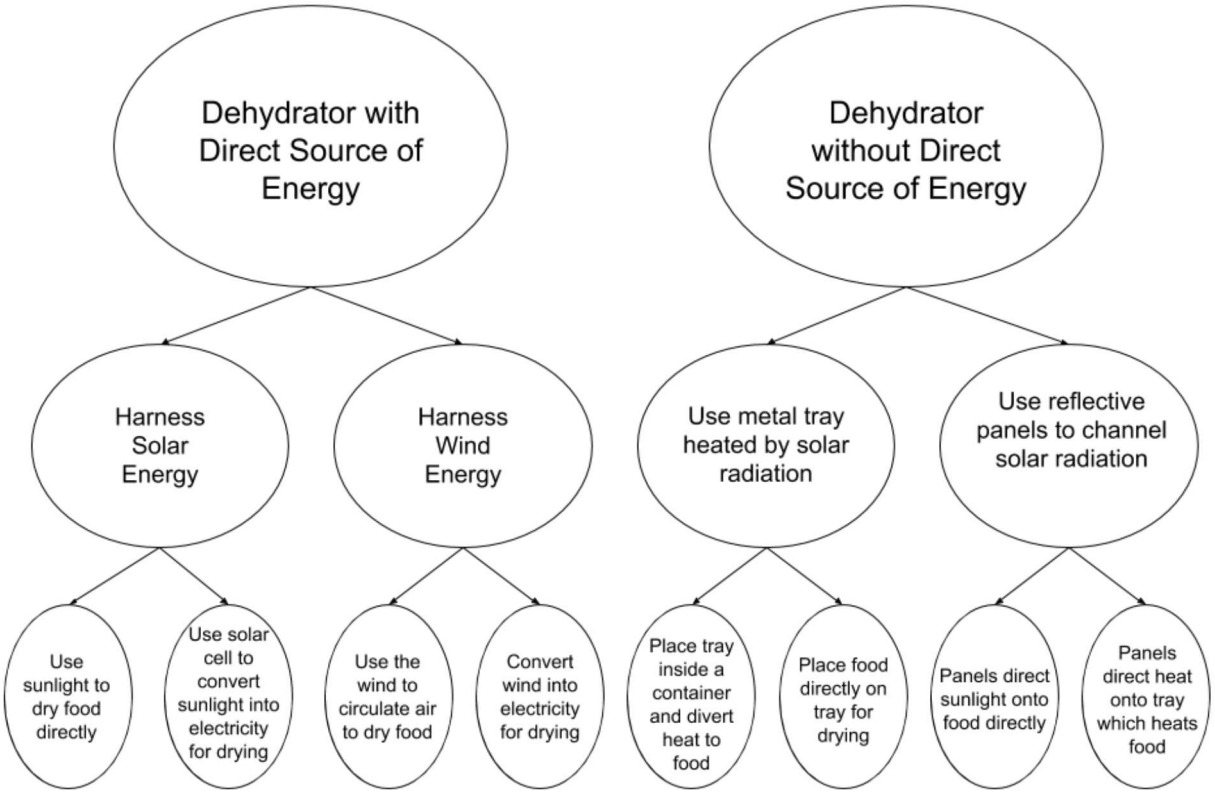
WE FOUND THAT THE FOOD DEHYDRATOR'S BASIC FUNCTION IS TO DEHYDRATE FOODS CAUSING THEIR HYDROGEN BONDS TO BREAK LEAVING LESS WATER IN THEM. THE FOOD DEHYDRATOR NEEDS A POWER SOURCE IN ORDER TO CAUSE THE FOOD TO BE DEHYDRATED. IT WOULD NEED A HEATING ASPECT TO RELEASE MOISTURE AND A VENTILATION SYSTEM TO GET RID OF IT (MOISTURE).

(PROBLEM STATEMENT)

The project must be constructed with $50 or less. This will restrict the choice of material for project construction. The food must be safely dehydrated, so air movement and heat are essential; Fruit & Vegetables 130°-140° F, Meats 145° F or higher, Herbs 95°-110° F. The dehydrator must fit inside one square meter. The project must be designed, budgeted, supported with data, and built within 10 weeks.

(Explanation)

In order to find a solution, the group researched what aspects a food dehydrator needs to function. Next, the team listed the restrictions of the project and how to build and design with those restrictions. The use of a Dunker Diagram was applied to help establish avenues to complete two possible designs.



Memo #3:

TO: Professors: Bornhorst, Mullin, Roach, Jenkins

TAs**:** Lucy Knowles, Nico Buxbaum

FROM: Team #A01 S.A.W.K: Steven Tom, Alharith Alghaithy, Wesley Kraintz, Kevin Medici

DATE: 10/14/19

SUBJECT: Background Research

Summary

It was found that multiple types of renewable energy sources are available to power a food dehydrator. A few examples are; solar, electric, and metal conductors. With the restrictions of the project, sunlight proves to be the best choice of energy, it is cost effective and efficient.

Research

In the article it is stated that "The Solar Cabinet Dryer developed by SEED consists of a Stationary Chamber built of Stainless Steel with a top glass cover at a 20° slant for proper radiation impact"(Eswara et al. 2013). This is relevant because, during this project, it is best to maximize the efficiency of the heating source, the sun. Also in this article, Eswara and Ramakrishnarao(2013) include other aspects of the "Solar Cabinet Dryer" as the solar fans included on the back of the design in order to get rid of moisture, a thermostat to regulate temperature, and air holes on the bottom of the design to circulate air flow.

The team decided to look into two other designs: one design created by Scanlin (2014) and another created by Madhlopa, Jones, and Saka (2001).

Although the design by scanlin (2014) is bigger than the allowed dimensions of 1 square meter, this design will allow the team to gauge what materials will be needed in order to construct the food dehydrator. Scanlin (2014) listed a number of materials including wood, for structure, metal mesh and aluminum, to absorb the sun's heat, and screws, nuts, and bolts, to fasten the materials together.

The design by Madhlopa, Jones, and Saka (2001) will help the team determine the mechanisms that will allow a food dehydrator to function. The design includes adjustable vents to control airflow and even has the type of glass that will give efficient solar energy. The design also describes how the air will flow inside the food dehydrator to provide the maximum amount of air flow based on the angle of the metal heat absorber.

The team also decided to research thermal conductivity of metals to determine the best type of metal and compare the cost. Thermal conductivity is an important factor in a food dehydrator because the greater the heat conductivity, the less time it takes to heat up the food, and ultimately shortens the process. MSKS (2017) states that copper is the best metal for heat conduction and aluminum is next. Aluminum is substantially more inexpensive and a better fit for this project.

Reference List

Eswara, A.R. Ramakrishnarao, M. J(2013). Solar energy in food processing—a critical appraisal. *Journal of Food Science and Technology*, 50(2), 209-227. https://doi.org/10.1007/s13197-012-0739-3

Madhlopa, A. Jones, S.A. Saka, J.D. (2001). A solar air heater with composite–absorber systems for food dehydration. *Renewable Energy* (pp.27-37). https://www.sciencedirect.com/science/article/pii/S0960148101001744

MSKS. (2017). Which Metals Conduct Heat Best? https://www.metalsupermarkets.com/which-metals-conduct-heat-best/

Scanlin, D. (2014). Best-Ever Solar Dehydrator Plans https://www.motherearthnews.com/diy/tools/solar-food-dehydrator-plans-zm0z14jjzmar

Memo #4:

TO: Professors: Bornhorst, Mullin, Roach, Jenkins

TAs**:** Lucy Knowles, Nico Buxbaum

FROM: Team #A01 S.A.W.K: Steven Tom, Alharith Alghaithy, Wesley Kraintz, Kevin Medici

DATE: 10/21/19

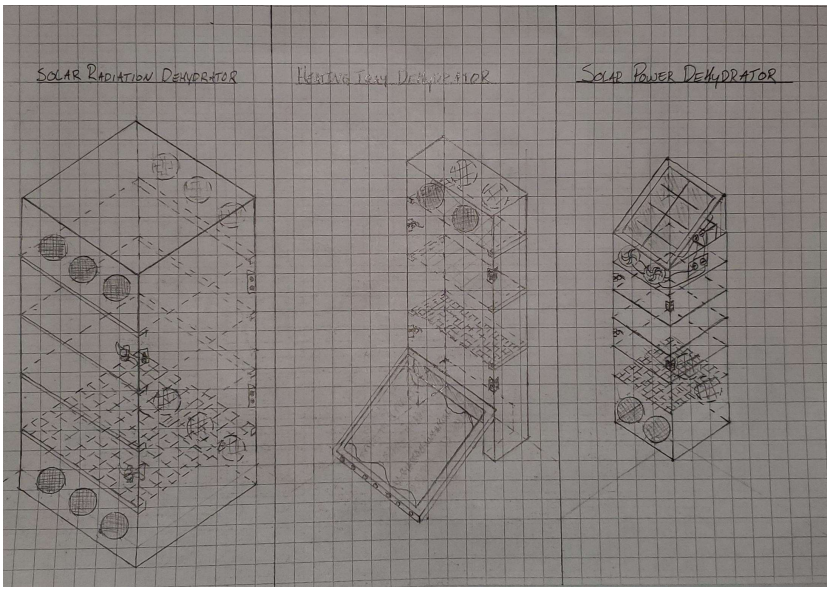
SUBJECT: Design Alternatives and Selection

Summary

Utilize a K-T Decision Analysis to

1) The Solar Radiation Dehydrator's purpose is to dehydrate food using solar radiation. In order to do this, the design is surrounded by plexiglass and has layers of trays. the food would be dehydrated by solar radiation, and in order to ventilate the moisture, the design includes air vents(covered by mesh to keep bugs away) at the top and bottom most layers to create air flow.
2) The Heating Tray Dehydrator which does not use solar radiation directly from sunlight but rather a heating tray. The design is a rectangular box that has stacks of trays but this build requires a heating tray connected to the bottom of the front. This tray connects to the main box and uses sunlight to absorb heat and then transfer that heat to the box via convection. Holes in the heating tray and on the top of the dehydrator are to allow air movement, and covered in mesh for sanitation.
3) The Solar Power Dehydrator is a design that has a solar cell on the top of the box which connects to a charge controller to power the fans and charge the battery. The battery is to power fans without sun. The exhaust fans circulate air and pull the moisture out of the system. The holes in the bottom allow for a draft, and covered in mesh for sanitation.

Sketches



K-T Decision Analysis

K-T Decision Analysis

Design Alternatives		A:		B:		C:	
MUSTS		Solar Power Dehydrator		Heating Tray Dehydrator		Solar Radiation Dehydrator	
1. Dehydrate Food		Yes		Yes		Yes	
2. Renewable Energy		Yes		Yes		Yes	
3. Costs under $50		No		Yes		Yes	
4. Does not exceed 1 square meter		Yes		Yes		Yes	
5. Food dried is safe to consume		Yes		Yes		Yes	
Keep Design?		No		Yes		Yes	
WANTS	**Weight**	**Rating**	**Score**	**Rating**	**Score**	**Rating**	**Score**
Efficiency (Time taken to dry)	7	6	42	8	56	8	56
Ease of Use	3	4	12	8	24	8	24
Safe to Operate?	8	5	40	5	40	5	40
Quantity of Food Dehydrated	6	4	24	6	36	8	48
Easy to clean?	4	7	28	7	28	7	28
Environmentally-Friendly	7	3	21	7	49	7	49
Lightweight	3	6	18	6	18	7	21
Aesthetically Pleasing	3	5	15	6	18	6	18
Total Score			200		269		284

Decision

The team decided to continue with research on the solar radiation dehydrator. With the given parameters to build the project, it is the best fit. The K-T Decision Analysis also backs this decision. The main reason for continuing with the Solar Radiation Dehydrator is the quantity of food which it will be dehydrating. The team is restricted to 1 m^2, without the need for a heating tray, more space can be dedicated to dehydration.

Memo #5:

TO: Professors: Bornhorst, Mullin, Roach, Jenkins

TAs**:** Lucy Knowles, Nico Buxbaum

FROM: Team #A01 S.A.W.K: Steven Tom, Alharith Alghaithy, Wesley Kraintz, Kevin Medici

DATE: 10/30/19

SUBJECT: Project Management

Summary:

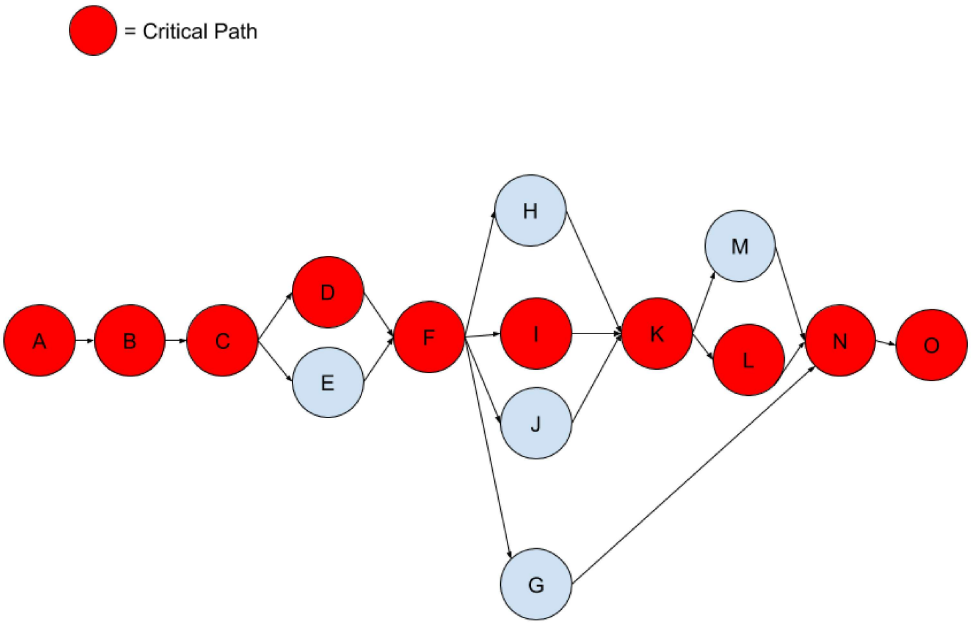
The purpose of this memo is to utilize a Work Breakdown Structure, Gantt Chart, and Network Diagram to establish the critical pathway. These are essential to establish a timeline for the project and they highlight the steps which cannot be delayed. If any steps along the critical pathway are delayed, the project's completion will be delayed.

Work Breakdown Structure(WBS)

Activity	Letter	Predecessor	Duration (days)
Team Charter	A	N/A	7
Problem Definition	B	A	5
Research Design Solutions	C	B	7
Create design ideas	D	C	7
K-T Decision Analysis	E	C	2
Project Management (WBS, Gantt Chart, Network Diagram)	F	D, E	9
Data Analysis/Statistics	G	F	2
Design Sketch with Dimensions	H	F	4
Solidworks Design	I	F	7
Determine project materials	J	F	1
Acquire Project Materials	K	H, I, J	3
Fabricate Components	L	K	7
Assemble Components	M	K	3
Test Design	N	G, L, M	7
Final Presentation	O	N	1

Gantt Chart

Network Diagram with Critical Path



Pathways:

1. **A-B-C-D-F-I-K-L-N-O* = 8.57 weeks (CRITICAL PATHWAY)**
2. **A-B-C-D-F-H-K-L-N-O = 8.14 weeks**
3. **A-B-C-D-F-I-K-M-N-O= 8 weeks**
4. **A-B-C-D-F-J-K-M-N-O = 7.14 weeks**
5. **A-B-C-D-F-J-L-M-N-O= 7.71 weeks**
6. **A-B-C-D-F-H-K-M-N-O = 7.57 weeks**
7. **A-B-C-D-F-G-N-O = 6.43 weeks**
8. **A-B-C-E-F-H-K-M-N-O = 6.86 weeks**
9. **A-B-C-E-F-I-K-M-N-O = 7.43 weeks**
10. **A-B-C-E-F-H-L-N-O = 7 weeks**
11. **A-B-C-E-F-I-K-L-N-O = 7.86 weeks**
12. **A-B-C-E-F-J-K-L-N-O = 7 weeks**
13. **A-B-C-E-F-J-K-M-N-O = 6.43 weeks**
14. **A-B-C-E-F-G-N-O = 5.71 weeks**

Memo #6:

TO: Professors: Bornhorst, Mullin, Roach, Jenkins

TAs**:** Lucy Knowles, Nico Buxbaum

FROM: Team #A01 S.A.W.K: Steven Tom, Alharith Alghaithy, Wesley Kraintz, Kevin Medici

DATE: 11/13/19

SUBJECT: Testing and Evaluation Plan

Summary

The team decided that mass is the best indicator to determine the amount of food moisture that is dehydrated. Temperature is also an important component because it is directly related to the speed at which food is fully dehydrated. Because of the need for multiple tests, S.A.W.K. has dedicated two weeks of testing to accommodate sound figures.

Test 1

Mass of food before and after drying (Woven Mesh vs. Wire Cloths Discs).

1) Test Plan

- Average moisture content of, evenly sliced, apples on two different types of stainless steel mesh.
- The food will be massed every two hours, once placed in the dehydrator with a total time of 12 hours in the dehydrator to see the change of moisture over time.
- This test will be repeated 3 times.

2) Evaluation Plan

- The average moisture content will be calculated and span the dehydration process which will produce a standard deviation so that the figures can be fitted to a uniform distribution.
- test the average moisture content of 12 apples slices with a weight of $3.5 \pm .4$grams in 4 hour intervals (12 hours of drying total) with the woven mesh versus the wire cloths disc mesh.

- The results will determine which/if steel mesh is more effective.
- M_W = Mass of water; M_I = Initial Mass; M_F = Final Mass; MC = Moisture Content Dehydrated.

  $M_W = M_I - M_F$

  $MC = M_W / M_I$

  Confidence interval on the difference of the means given a small sample size ($n < 30$):

$$(\overline{X}_1 - \overline{X}_2) \pm Tcritical\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

  $df = \min(df_1, df_2)$

- After gaining the moisture content of the food, the average, standard deviation, and confidence interval will be calculated for both meshes (6 masses for each) for each interval of time. We will compare the two meshes by having 3 samples of the woven mesh and 3 samples of the wire cloth discs mesh. we will take the confidence interval of each time interval and compare the results using a 95% t critical value. We If the confidence includes a zero then the means are not different, making both meshes reliable. However, if the confidence interval were to far away from zero then the means are more likely to be different.

Test 2:

Temperature of the food dehydrator during dehydration

1) Test plan
   - We will measure the interior temperature of the food dehydrator.
   - The temperature will be taken before drying and then every 2 hours to monitor the change in temperature. The drying process will take 12 hours.
   - This test will be repeated 3 times.

2) Evaluation plan

- We will test the temperatures in each interval and then calculate the mean standard deviation of each time period to see how far away each temperature is from each other in that time period
- We will compare how the average temperatures through each test is similar which will imply how consistent it will be.
- The standard deviation equation $s = \sqrt{\sum_{i=0}^{7} (x_i - \bar{x})^2/(N-1)}$ to determine how far away the intervals are for all 7 time interval temperature tests.
- We will calculate values our mean and standard deviation of each interval in order to compare the temperature efficiency of each interval. We will then calculate how the temperatures consistency is through comparing the averages of each trial.

Appendix C. Revised Resume

Wesley Kraintz

28800 County Road 29 • Winters, CA 95694 • (530) 383-7400 •
wpkraintz@ucdavis.edu

EDUCATION

- University of California, Davis - Davis, CA - (**2019-Current**)
  - Undergraduate in Biological Systems Engineering (**Graduation June 2021**)
- Woodland Community College - Woodland, CA - (**2016-2019**) GPA: 3.94
  - Associates Degrees in science in Life Sciences & Mathematics - May 2019
- Texas Agriculture & Mechanics University - College Station, TX - (**2011-2013**)
  - Credits toward Bachelors of Science in Animal Science
- Redlands Community College - El Reno, OK - (**2009-2011**) GPA: 3.99
  - Associates Degree in science in General Agriculture - May 2011

WORK EXPERIENCE

Undergraduate Research Assistant for Sierra Nevada Research Institution - UC Davis, Ca (2019-Current)

- Duties Include:
  - Implementation of delicate instruments
  - Construction of wireless network
  - Perform calibrated measurements
  - Technology integration for research

Student Success Center Student Employee - Woodland Community College, Woodland CA (2017-2019)

- Duties Include:
  - Record keeping,
  - Tutoring a diverse student base
  - Supplemental Instruction Leader and Leader Trainer
  - Math Engineering Science Achievement (MESA) mentorship

Farmhand at Rominger Brothers Farms - Winters, CA (2015-Current)

- Duties Include:
  - management of riparian/wildlife rehabilitation,
  - support to university research and NRCS,
  - mechanic work, equipment operation, irrigation, shop fabrication.

Vet Technician at Biosurge - Winters, CA *(2011-2013)*

- Duties include:
  - Vet technician
  - Animal husbandry
  - FDA sanctioned research using Good Laboratory Practices
  - Proper record keeping for professional research

SKILLS

- Experience with laboratory Standard Operating Procedures
- Proficient in instrument reading and data collection
- Tutoring/Communicating to an ethnically diverse audience
- Microsoft Word, Excel, PowerPoint, Trimble GPS systems
- Machinery Mechanic/Fabricator/Welder/All-terrain equipment operation
- Bilingual- Spanish/English

HONORS AND AWARDS

- MESA Club VP & President (2017-2019)
- Redlands Community College Outstanding Agriculture Student (May 2011)
- National Academic All-American Collegiate Livestock Judging Member (April 2011)
- Phi Theta Kappa Honor Society (2009-2011)

Alharith Alghaithy

2065 West El Camino Ave, Sacramento, CA 95833
Phone: 661-800-8151 Email: alharithalghaiti@gmail.com

Education

University of California, Davis
Bachelor of Science, Electrical Engineering
Expected to Graduate May 2022

Experience

Introduction to Engineering Design(Communication Class) Jan. 2019 - Mar. 2019
University of California, Davis

- Investigated student farm and found that pests were eating the crops that were being produced
- Corresponded with a team to design a device to detect pests on the student farm by doing team meetings and providing insights on the project as to what could be improved
- Presented to guests on the prototype and explained how the prototype is able to warn the farm manager if pests are detected

Highway Cleanups Sept. 2016 - May 2018
Golden Valley High School Interact Club, Bakersfield CA

- Completed volunteer work and served the public by picking up waste on the road
- Achieved a sense of connection with community through these experiences and being able to help a community that is welcome to its members
- Influenced others to join the club and to be able to engage with the community by joining the cleanups

Activities

CASL- Leadership Development Day Sept. 2017
Golden Valley High School ASB, Bakersfield CA

- Led a group and learned to be able to communicate with them
- Learned to create bonds by being able to share with others and to be able to relate to each others' experiences
- Demonstrated teamwork by communicating to complete a series of tasks such as figuring out puzzles or making an outfit with limited supplies

High School Rallies Sept. 2017 - May 2018
Golden Valley High School ASB, Bakersfield CA

- Organized three rallies in that year by coming up with games and activities that can be hosted
- Designed the rallies by setting up decorations and games before they started
- Influenced other students to participate in the rallies by asking them to get tickets to be able to play in the games

Membership

Interact Club, Golden Valley High School 2016-2018
ASB member, Golden Valley High School 2017-2018

Skills

Competent in Arabic
Sketching

Steven Tom

611 Bay St Apt #4, San Francisco, CA 94133

Phone: 415-987-8731 Email: sltom@ucdavis.edu

Objective

Obtain an internship over the summer at a company focused on Biological Systems Engineering with an emphasis in Biotechnology in order to gain work experience and learn more about the field.

Education

University of California - Davis, Davis, CA Expected June 2023

Bachelor of Science, Biological Systems Engineering

Work Experience

Alcatraz Gift Shop, San Francisco, CA

Cashier/Courier 2019 (June-September)

- Interacted with customers and provided customer service
- Handled customer purchases
- Delivered merchandise and other items from store to store

Relevant Experience

Eagle Scout Project (Scouts BSA) 2019

- Organized and directed the renovation of Quarry Trail Park in Brisbane, CA
- Developed a plan on how to complete the project including materials needed, available volunteers, and tasks to be completed
- Coordinated with Brisbane Parks and Recreation to have the project approved by Brisbane City Council
- Delegated tasks to scouts and volunteers
- Completed the project in a timely manner and followed the plan I created

Skills

- Proficiency in Solidworks
- Basic First Aid (Learned in Scouts BSA)

Memberships and Awards

Archery Club (UC Davis) 2019

AP Scholar Award with Distinction 2019

Robotics Club 2016-2019

- Robotics Club President and Team Leader (Team B) 2018-2019
- Mentored newer members in design and construction of robots
- Achieved 2nd Place in Regional VEX Robotics (EDR) Tournament 2019
- Led the construction of the robot as Team Builder 2016-2018
- Delegated construction tasks to team members

Scouts BSA 2012-2019

- Led my troop as Senior Patrol Leader 2016-2017
- Coordinated meetings and events for the troop
- Taught new scouts basic skills including first aid, knot-tying, and camping preparation
- Compiled notes and agendas for troop as Scribe 2018

Kevin Medici

336 C Street Davis California 95616
Email: kemedici@ucdavis.edu Phone Number: (760) 529-1716

Education

University of California Davis, Davis CA
Bachelor of Science, Biological Systems Engineering — Expected December 2021

Experience

Frazier Farms, Oceanside, CA — Summer 2017

Courtesy Clerk

- Attained a clean healthy environment in the Grocery store
- Optimized communication skills with coworkers by meeting hourly to discuss the next tasks we would like to complete
- Prioritized bagging for customers to increase the amount of customers

Vector, Carlsbad, CA — Summer 2017

Sales associate

- Scheduled appointments for selling cutco knives and delivering a pitch for the product
- Increased sales by selling over $3,000 worth of knives
- Utilities networking skills to obtain a higher amount of customers

Relevant Course Projects and Experience

EBS 1 - Foundation for Biological Systems Engineering — Current

- Fabrication of Food Dehydrator through understanding the engineering design process
- Applied statistical analysis on testing the impact of material on the dehydration of different fruits
- Maintained meeting in 4 person group by taking role and organizing individual tasks

Activities

Fraternity leadership roles

Phi Delta Theta Community Service Chairman — Winter 2019-Current

- Inspired members of my fraternity to increase amount of community service hours by 50%
- Lead fraternity to becoming the greek weekend of service champions where we had 58 hours of community service in a weekend

Phi Delta Theta Warden Chairman — Spring 2019-Current

- Maintained meetings to ensure chapter members speak in a civilized manner

NBC Student of the Month — March 2017

- Obtained the recognition to be on the well known NBC channel for extensive community service hours with special needs children, beach cleanups, and animal rehabilitation