Tray de Soleil Final Results

Tray de Soleil was the final prototype we designed as a group in the search of a tray design that would be light in weight, easy to clean, food grade, durable (to last a minimum of three years) and affordable at a cost under $10. After building our second prototype we carried out different tests to assess its effectiveness in meeting our desired features.

Table 1.1: Test for Prototype #1 (10/3/13) and Prototype #2 (10/10/13)

Test	Description of Test	Results for Prototype #2	Results for Prototype #1
Cleaning Test	Hand washing with wet cloth for one minute and a half	Fewer remnants were left over compared to first prototype	Barely any remnants left in the wire mesh. (**See Figure 1**)
Capacity	Placed banana slices, all ¼ inch thick, onto tray edges about 1/8 inch apart	The tray holds 84 banana slices, slightly fewer, due to the added middle wood piece	From our calculations (7x13) 91 bananas fit. In **Figure 2** it is apparent that it's capacity was greater than initially expected
Durability	Attempt to bend and warp the tray continuously for one minute	The tray survived the test and was very rigid and unmovable **(Figure 4)**	The tray was very flimsy and flexible but would return to its normal shape upon ending the test **(Figure 3)** Frame has a thickness of 0.5" x 0.75"
Reasonable Cost	Total price spent constructing dryer tray is under $10	Using Home Depot Prices <u>Wood:</u> 12"x3/4"x1/2" is $0.86 So for 5.8ft, $4.99 <u>¼" Wire Mesh</u> One roll of wire mesh is $10.38 for 2 by 5 ft Our tray is 1.5 by 1	Using Home Depot Prices <u>Wood:</u> 12"x3/4"x1/2" is $0.86 So for 5ft, $4.30 <u>¼" Wire Mesh</u> One roll of wire mesh is $10.38 for 2 by 5 ft Our tray is 1.5 by 1 which costs $1.60 <u>Screws:</u>

		which costs $1.60 <u>Screws</u> A bag of 50 screws costs $3.95, so for 13 screws the cost is $1.04 **Total Cost: $7.63**	A bag of 50 screws costs $3.95, so for 13 screws the cost is $1.04 **Total Cost: $6.94**
Drying Effectiveness	Weigh the tray before and after heating the bananas with a hairdryer in order to see how much water was evaporated	Banana slices all ¼ inch thick Temperature: Ranged between 50-54 degrees for 15 min with hair dryer Weight before: 279.8g Weight after: 271.3g **(Figure 5)**	The first prototype yielded a loss of 7.2 ounces of water from the bananas after heating in an oven for 6 hours.

<u>Costs Calculations for Actual Sized Dryer Tray</u>

<u>Description of Test:</u>	**<u>Price Calculations:</u>**
Total price spent constructing dryer tray is over $10 for the tray that is 18" X 36."	Using Home Depot Prices <u>Wood:</u> 12"x3/4"x1/2" is $0.86 Adding up to $9.03 <u>¼" Wire Mesh</u> One roll of wire mesh is $10.38 for 2 by 5 ft Our tray is 1.5 by 3 which costs $4.80 <u>Screws</u> A bag of 50 screws costs $3.95, so for 13 screws the cost is $1.04 **Total Cost: $14.87**

Test Report Summary

Our design for the second prototype exceeded our expectations in many of our designated tests except in the cost category. Although our prototypes were well under $10, the actual size requested was $14.74. Various tests were conducted with favorable results.

<u>Cleaning Test:</u>

From the first prototype we noticed that our design was fairly easy to clean as only few, small banana pieces remained after using a wet cloth to wipe the tray for one minute (see Figure1.) With the second prototype the results improved due to a stronger tray that allowed one to scrub harder. Thus, we agreed that the tray met the requirements for this feature.

Figure 1: Prototype #1 After Cleaning Test

<u>Capacity:</u>

The capacity for the second prototype decreased by seven slices due to the addition of the wooden piece in the center, yet it was not a significant amount. With careful placement, this loss of capacity can be made up for. The tray continued to exceed our expectations for capacity as it currently fits 84 banana

slices (1/4 thick). In reality, the dimensions of the tray will be bigger than our second prototype, thus increasing the capacity significantly.

Figure 2: Prototype #1 Demonstrating Capacity

Durability:

Improvements were made to make the tray more durable since the first prototype failed the durability test. The frame was redesigned and the corners were altered from being angled to rectangular joints. Additionally, a wooden bar was placed in the center of the tray for additional support. Four more screws were also added to support the wire mesh and make it more stable. It was very important for our team to meet this feature, as we understand that this is an

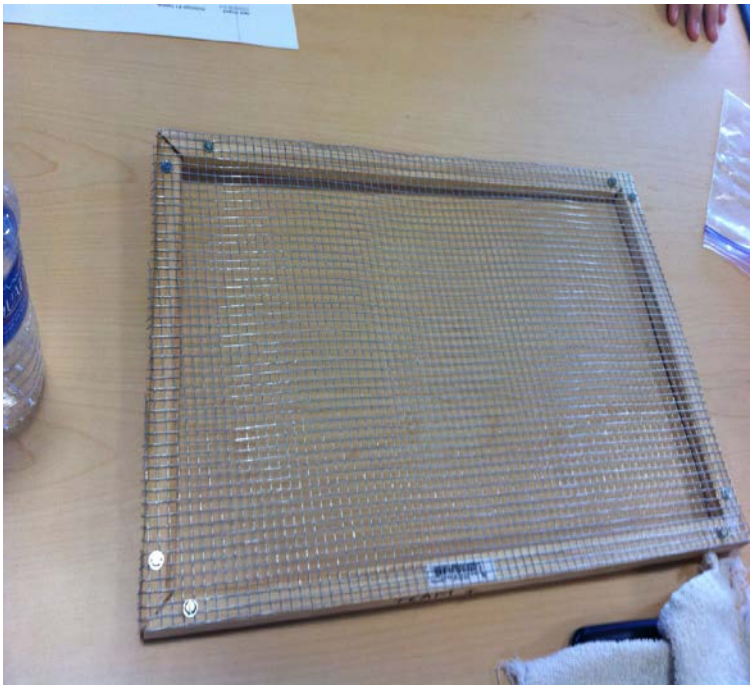

Figure 3. Prototype #1 Weak Frame

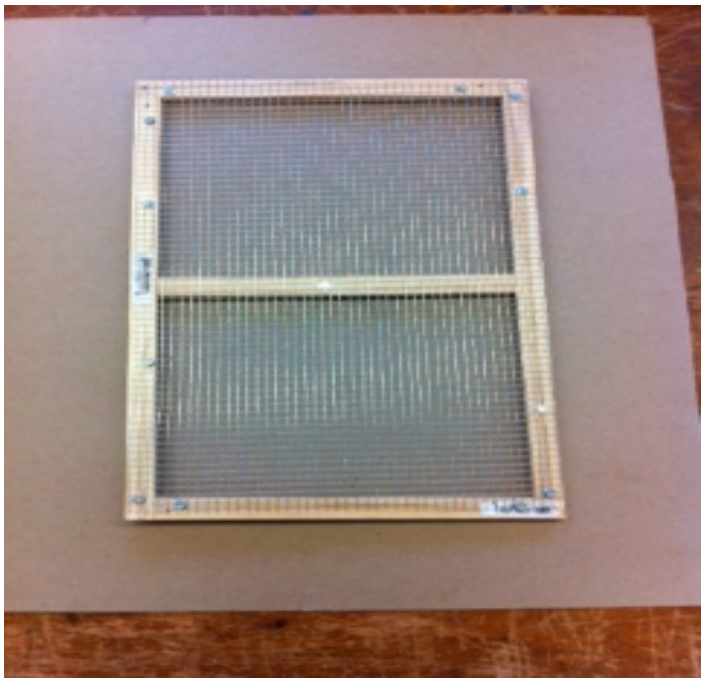

Figure 4. Prototype #2 Sturdy Structure

investment and should be able to withstand several washes and last for 3-5 years.

Cost

The cost increased from the first prototype, yet it was still within the $10 budget for the second prototype, which was $6.59. Unfortunately, if the tray was made the requested size, it would cost $14.74 which exceeds the target price by $4.74. With more time our group would redesign the tray to use less material (especially by reducing the amount of screws used), ultimately reaching a price under $10.

Drying Effectiveness

After drying the banana slices all remained intact and none broke. The tray was effective in drying the banana slices and in fact 8.5g of water evaporated in 15 minutes of drying with a hair dryer, which is considered a complete cycle.

Figure 5: Prototype #2 (being dried by a hairdryer)

Improvements:

Overall, we were satisfied with our results from the first and second prototypes. However, there are a few adjustments that could be made to improve the design further, which would include dimensioning the length of the tray more accurately (our prototype #2 was a little shorter than intended). Additionally, our goal is to meet the $10 budget, which would require a design that uses less material. We have tried to minimize our cost by using the least amount of wood and screws possible by using a thin frame (thickness 0.5 in x 0.75 in).

Food Grade Material:

The hardware cloth used is galvanized with a double coat of zinc coating for maximum rust protection. Research has shown that drying acidic fruits may cause the metal to corrode. Therefore, more effective material could be used that would be safer to eat from and FDA approved. This could be galvanized steel that has been approved by the FDA. We are aware that the price would rise but it would be worth the money to complete the design.

Flexibility:

One key benefit in our tray is that the food easily came off of the wire. One could manipulate the wire in a few ways, which would allow stickier foods to peel off from the tray with ease.

Suggestions to HESE students:

Overall the Tray de Soleil is a design that is easy to manufacture. It should be noted that food should not be placed on the middle wooden piece, as it will make cleaning harder. But overall our design meets and surpasses almost every constraint and design goal.

Sources:

http://www.homedepot.com

http://www.galvanizeit.org/hot-dip-galvanizing/how-long-does-hdg-last/contact-with-food/