Assignment 6: Drawing

Problem Statement

The purpose of my design is to help utilize the limited space in my small kitchen, the design must fit into all of my design parameters which include: easy to use by myself and all my roommates, compact, durable, relatively inexpensive, and easy to assemble and/or disassemble. Through previous assignments the design chosen is a shelf with a horizontal translation. The movement of the shelf is achieved through a wheel bearing and track combination. As the final part of this project, I must now decide on the final details and components that will make up the shelf. I must design a final draft of all the components and subassemblies and construct a bill of materials for any parts used.

Assumptions About the Problem

For this assignment, I must make final decisions about the components that make up my design. These components must be accounted for in my final drawings and bill of materials. Some problems I may run into in this part of the project are ensuring that all my components will fit together with proper tolerances.

Pugh/Decision Matrix

Component Analysis:

In order to achieve the proper movement of the shelf, I came up with three different designs that result in the horizontal translation of the shelf. In the previous assignment I analyzed these three different components. Now I must reanalyze these components and ensure that they will result in the best design possible. The designs were:

1) Dove tails- Shelf fits into dove tail slots and slides in and out
2) Wheel bearings on shelf- Shelf has rollers that slide in and out of a slot built into the structure.
3) Wheel bearings and track combination- Shelf and structure have tracks that interlock and rollers that slide.

FRDPAARC Table for each of my components:

FR	DP	A	R	R	C
Dove tail (figure 1)	Shelf fits into slot using dove tails	P=Tw Shear/bending of shelves Friction force $F_f = \mu N$	https://byjus.com/physics/kinematics-rotational-motion-around-fixed-axis/	Friction, dove tails grinding	Have clearance for them to slide, keep lubricated. Design with coefficient of friction in mind
Wheel bearing on shelf (figure 2)	Shelf has rollers that slide in a slot on the stucture	P=Tw Shear/Bending of shelves Friction force $F_f = \mu N$	https://byjus.com/physics/sliding-friction/	Friction, wheels jamming	Keeps shelf light, design with coefficient of friction in mind.
Wheel bearings on structure (figure 3)	Structure has two sets of parallel rollers	P=Tw Shear/Bending of shelves Friction force $F_f = \mu N$	http://www.animations.physics.unsw.edu.au/jw/rolling.htm	Friction, wheels jamming	Keeps shelf light, design with coefficient of friction in mind.

Evaluation Criteria Analysis:

- Ease of Use: The shelf must be easy to operate and reliable for my roommates and myself. Designs that result in a greater amount of friction or have higher chances of breaking will receive lower ratings.
- Durability: The shelf must be able to withstand common wear and weight placed on it. Shear and bending will equally affect all three alternatives.
- Easy Assembly/Disassembly: The shelf must be able to be taken apart and put together easily. Less parts will result in a higher rating.
- Inexpensive: The parts that make up the shelf and any modifications made into the structure will account for additional cost. Therefore, simpler designs will result in a cheaper cost of production.

Final Decision Matrix

Relative Weights	Evaluation Criteria	Alternatives					
		Dove Tail		Wheel bearings on shelf		Wheel bearings and track combination	
		Rating	Score	Rating	Score	Rating	Score
30%	Ease of Use	3	0.90	3	0.90	4	1.2
30%	Durability	5	1.5	2	0.60	4	1.2
20%	Easy Assembly/Disassembly	3	0.60	5	1.00	5	1.00
20%	Inexpensive	2	0.40	5	1.00	5	1.00
100%			3.4		3.5		4.4

Based on the decision matrix and the scores indicated in the above chart, the final design will obtain its horizontal translation though a wheel bearing and track combination.

Solutions

Bill of materials

BOM Level	Part #	Part Name	Description	Quantity	Unit of Measure	Procurement type	Reference Designators (link in notes)
1	454532	Sandle Plywood	(1/2''x48''x96'') sheet of sandle hardwood plywood	1	inches	Bought off the shelf and then cut down to size	Home depot
2	60135K51	Corrosion-Resistant Track Roller	Threaded roller	6	mm	Bought off the shelf	McMaster-Carr
3	60135K521	Corrosion-Resistant Track Roller Guide Rail	Guide rails for shelf	2	inches	Bought off the shelf	McMaster-Carr
4	62000	Wood Glue	8 oz bottle of wood glue for assebly	1	ounces	Bought off the shelf	Home depot

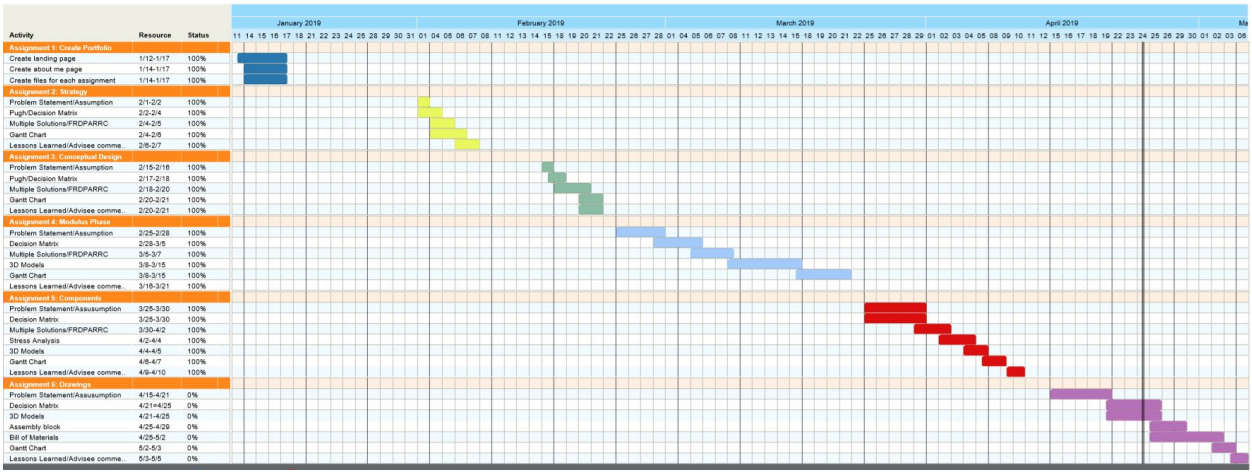
Notes:

- Plywood will be cut into 4 pieces
    - 2 x (13'' x 15.5'')
    - 1 x (11'' x 12.5'')
    - 1 x (13'' x 12'')
    - 1 x (15.5'' x 11'')
- The 11''x12.5'' sheet of plywood will have three hole drilled on each side
- All other parts will be pulled off shelf and able to assemble as it

Supplies Links:

- Plywood- https://www.homedepot.com/p/12mm-Sande-Plywood-1-2-in-Category-x-4-ft-x-8-ft-Actual-0-472-in-x-48-in-x-96-in-454532/203414055
- Roller- https://www.mcmaster.com/60135k51
- Track guide- https://www.mcmaster.com/60135k52
- Wood Glue- https://www.homedepot.com/p/Gorilla-8-oz-Wood-Glue-62000/100672167

Gantt Chart



Lessons Learned

- Designing a part requires in depth analysis, such as required materials, bolt and screw size, etc.
- The proper orientation of an engineering Multiview drawing goes top, front, side
- How to place tolerances on the proper drawing

Comments to each advisee

Jake Weber- Update Gantt chart to fit current due dates, include past FRDPARRC tables when showing component analysis, have proper dimensioning on designs.

Cameron Klovstand- Make sure your drawings are in proper alignment, have an updated decision matrix for components.