

# KINETIC SCULPTURE

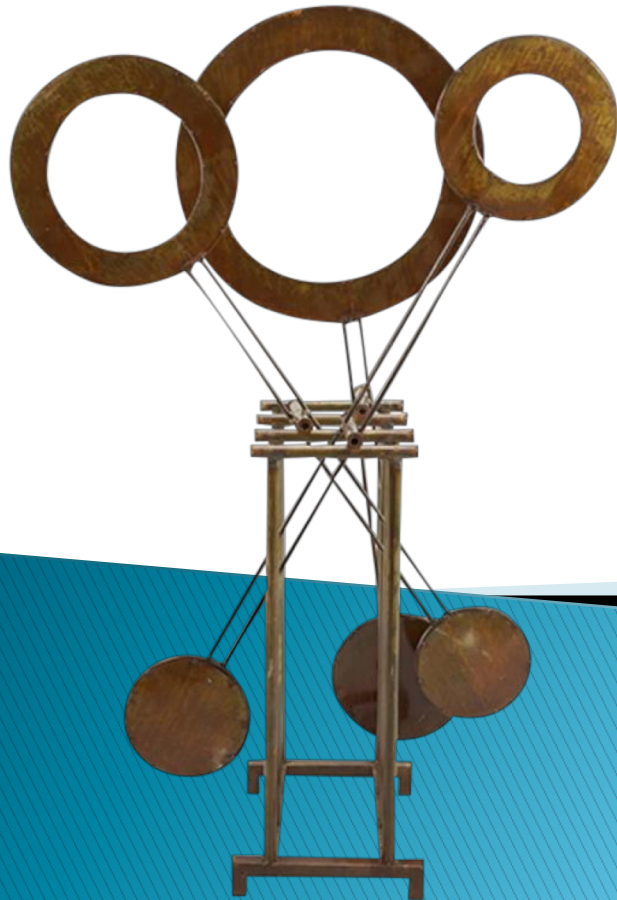
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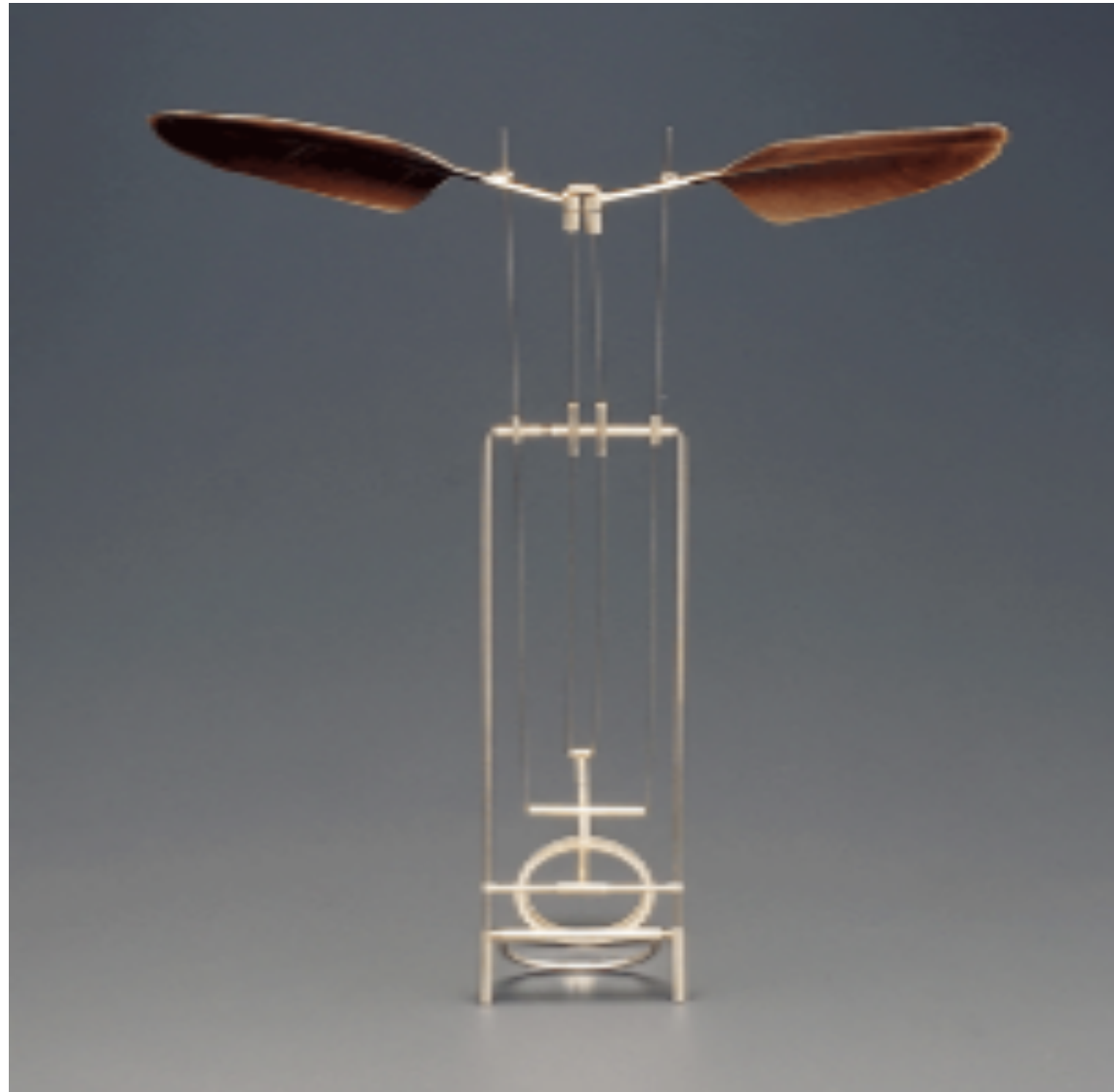


Figure 1: Idea being influenced from

# Introduction

- ▶ Project aim is to make a Kinetic Sculpture
- ▶ Sculpture
  - An artificial man-made structure for any living or non-living thing
- ▶ Kinetic
  - Any object in motion or moving
- ▶ Kinetic Sculpture
  - An artificial structure which shows movement

# General Description

- ▶ Team is working on Kinetic Sculpture with aim to show some interest towards the Mechanical Engineering Department
- ▶ To provide physical example of Mechanical Engineering Principles
- ▶ Using an entertaining interactive display
- ▶ It's the motion of parts that could either move partly or having to move all together.

# Client & Sponsor

- ▶ Client

- Dr. Sarah Oman

- Mechanical engineering professor, NAU

- ▶ Sponsor By

- Mechanical Engineering Department, NAU

- ▶ Project is important to show the Mechanical Engineering Principles and illustrate the Engineering Building and represent the ME department in a positive and marketable way.

# Project Description

- ▶ The project involves designing the kinetic sculpture
- ▶ The design of the sculpture is in such a manner that the bird lies over a box.
- ▶ Principles used and finalized are gears, shaft, spring, and V-belt meeting the customer requirement of at least three mechanisms
- ▶ The wings will be used in the sculpture work to demonstrate the movement
- ▶ The gears, motors and shafts will be primarily used to facilitate the movement of the wings.

# The Project Description (Continued)

- ▶ The main purpose of the sculpture is to facilitate learning mechanical engineering concepts
- ▶ The sculpture will be used as an example of useful application of the mechanical engineering principles



Figure 2: Minimized Device of original

# Updates

- ▶ There are many changes that have been made to the model
- ▶ One of the changes is with regards to the size of the materials
- ▶ The device will increase in weight, but still ensuring that it can be carried by two people
- ▶ The changes are made to help meet the specification of the customer.
- ▶ A new mechanism has been added.



# Update (V-Belt)

- ▶ A new mechanism has been added and that is the V-belt
- ▶ This update has been added to help add an extra movement into our bird (tail)
- ▶ Analysis has been done to help know how much extra force would be needed.

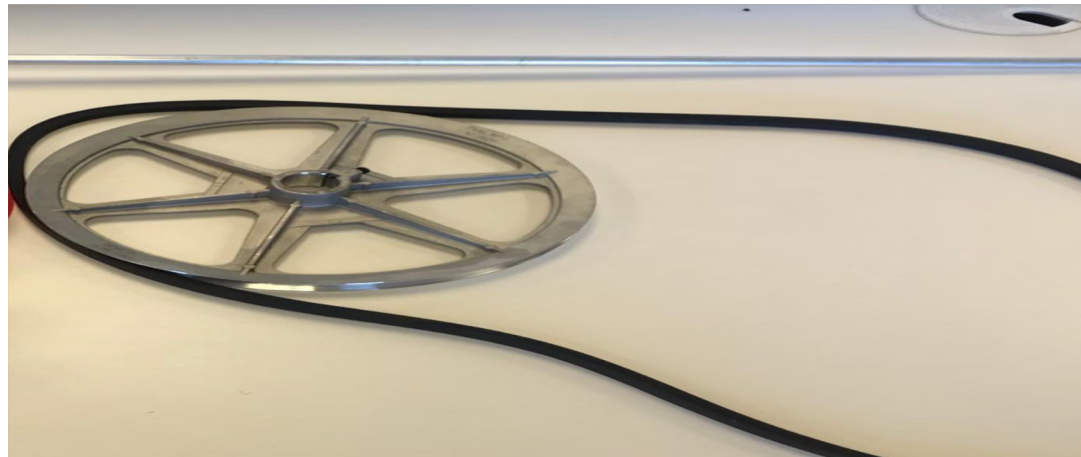


Figure 3: V-belt

# CAD

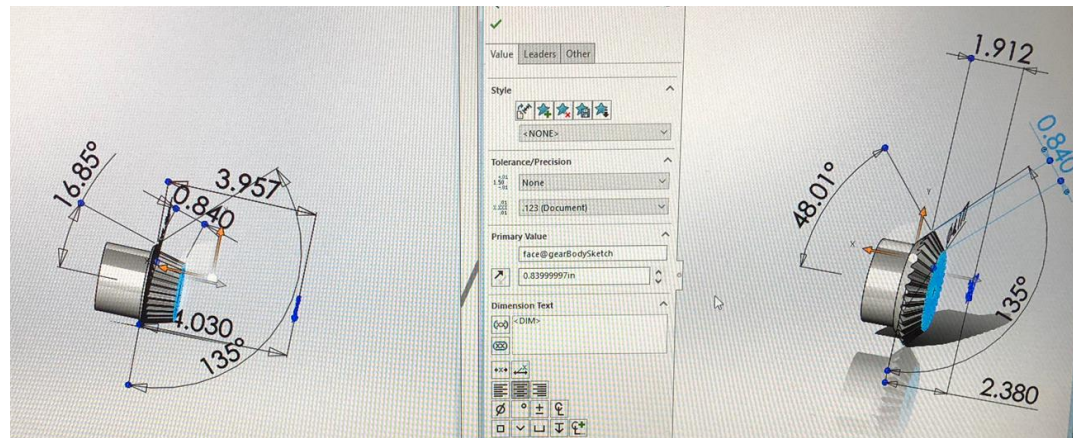


Figure 5: Mistakes

Problems  
& Updates

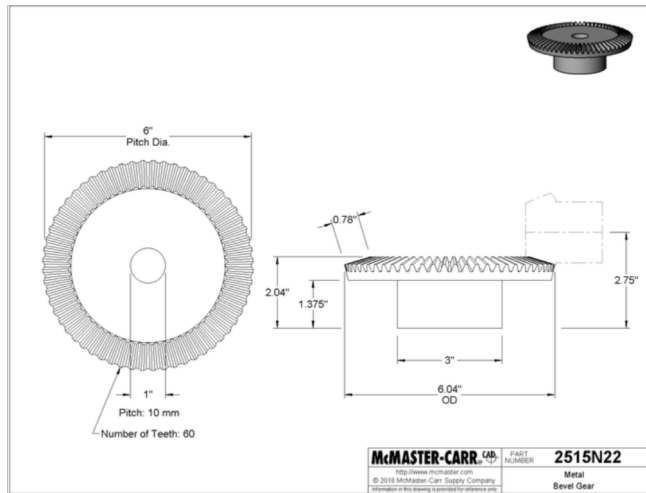


Figure 6: A 6 inch drawing file of bevel Gear [5]

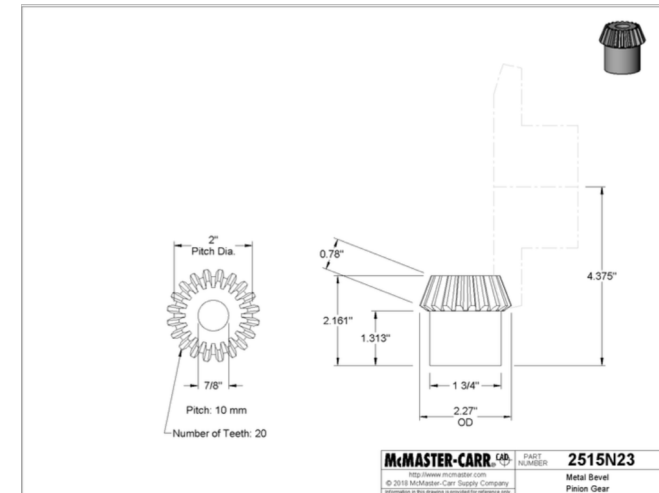


Figure 9: a 2 inch drawing of bevel gear [5]

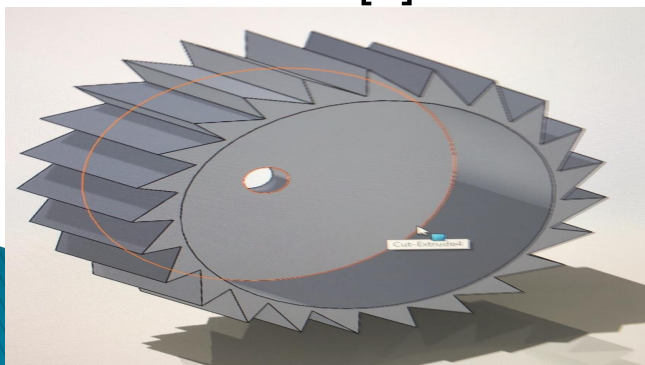


Figure 7: Ratchet Gear

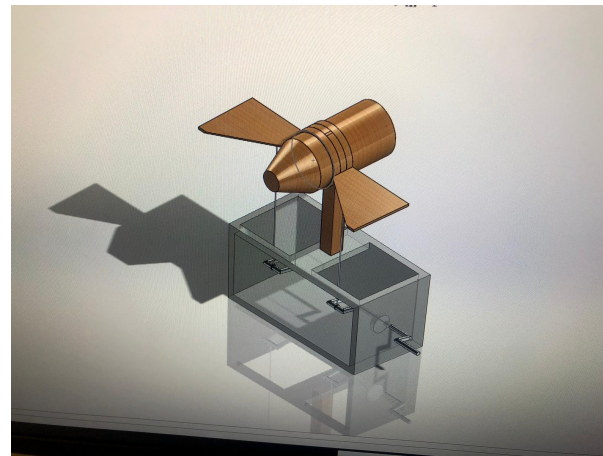


Figure 8: Old initial idea

# The Dimension of Changes

- ▶ A basic sketch on how it would look like would be located on the figure in the right.

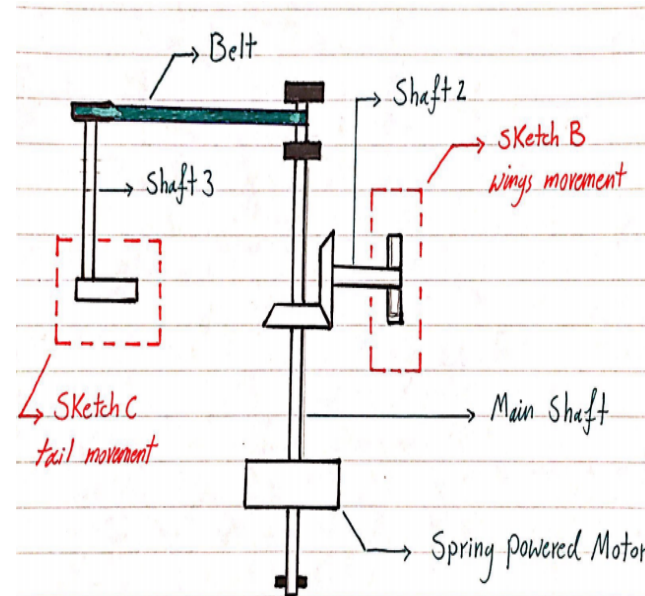


Figure 10:  
Sketch



Figure 11:  
Spring and gear

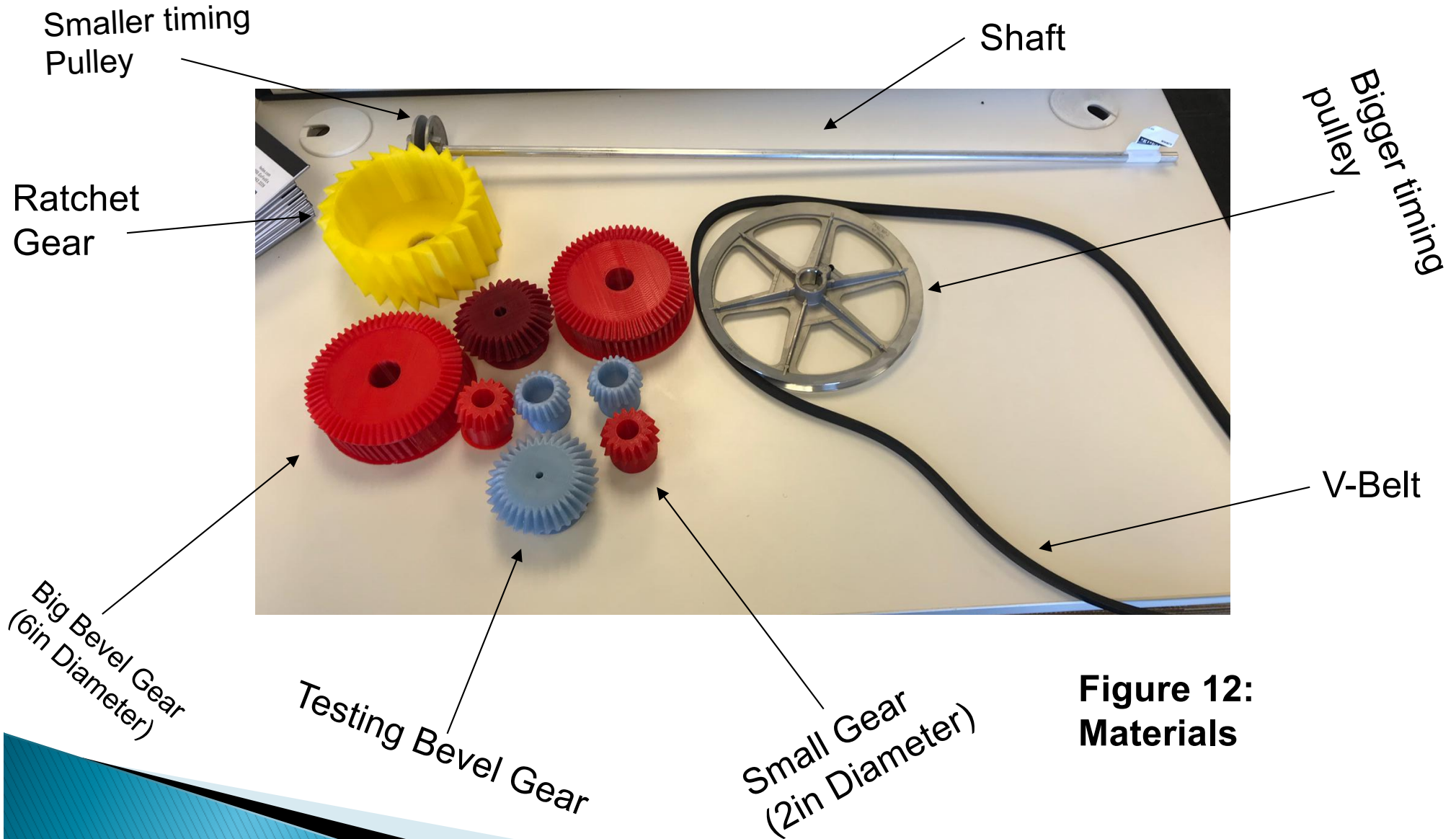
# Moving Forward

- ▶ The project is categorize the kinetic sculpture of the bird as an appropriate device.
- ▶ The manufacturing phase will consider ideal measures
- ▶ The specification of the customers is considered and integrated as we are currently manufacturing.
- ▶ The process of manufacturing left for our project is fixing the loosen spring by replacing it
- ▶ Testing requires updates once the spring is developed

# BOM

| Bill of Materials |                         |     |                                    |   |          |                    |                 |                       |
|-------------------|-------------------------|-----|------------------------------------|---|----------|--------------------|-----------------|-----------------------|
| Team              |                         |     |                                    |   |          |                    |                 |                       |
| Part #            | Part Name               | Qty | Description                        | Functions                                     | Material | Dimensions         | Cost            | Link to Cost estimate |
| 1                 | Liquid Super Glue       | 1   | Use to stick the material          | Create strong bonding                         | Chemical | -                  | \$5.97          | Hom Depot             |
| 2                 | Poplar Board            | 1   | For the box                        | To put items in the box                       | Wood     | 0.25 x 3.5 x 48 in | \$5.98          | Hom Depot             |
| 3                 | Black PVC Project Board | 1   | PVC board is strong to bend        | For making the upper part                     | PVC      | 0.118 x 24 x 36 in | \$4.04          | Hom Depot             |
| 4                 | Stop Set                | 1   | to stop the running part           | Put to stop the rotation                      | Aluminum | 1/4 in             | \$1.92          | Hom Depot             |
| 5                 | Stop Set                | 1   | to stop the running part           | Stop the motion                               | Aluminum | 1/16 in            | \$1.24          | Hom Depot             |
| 6                 | Strap Hinge             | 1   | Provide open close option          | To put on the door                            | Steel    | 2 in x 4 in        | \$2.97          | Hom Depot             |
| 7                 | Brazing Rods            | 1   | For making connection              | Hold the top system with the rod              | Aluminum | 36 x 4 x 4         | \$4.21          | Hom Depot             |
| 8                 | Flat Plate              | 1   | A straight sheet to make anything  | Make the fins                                 | Aluminum | 36 x 4 x 8         | \$4.28          | Hom Depot             |
| 9                 | Hinge                   | 1   | Hold for open close                | To put the door with it                       | Steel    | 2 x 5 in           | \$1.97          | Hom Depot             |
| 10                | Round Rod               | 1   | A rod to attach things             | Make the Central standing part                | Steel    | 36 x 2 x 2         | \$5.77          | Hom Depot             |
| 11                | Dowel                   | 1   | Cylindrical rod                    | Put in the system                             | Wood     | 1/4 x 48 in        | \$4.98          | Hom Depot             |
| 12                | Dowel                   | 1   | Cylindrical rod                    | Put in the system                             | Wood     | 1/2 x 48 in        | \$1.75          | Hom Depot             |
| 13                | Dowel                   | 1   | Cylindrical rod                    | Put in the system                             | Wood     | 1/8 x 48 in        | \$4.48          | Hom Depot             |
| 14                | Round Rod               | 1   | A rod to attach things             | Make the Central standing part                | Zinc     | 36 x 3 x 1/16 in   | \$2.97          | Hom Depot             |
| 15                | Wood Glue               | 1   | Sticky action                      | Create strong bonding                         | Chemical | -                  | \$3.97          | Hom Depot             |
| 16                | Shaft                   | 1   | An aluminum pipe                   | welded to be a shaft                          | Aluminum | D=1" , L=48"       | \$27.49         | Amazon                |
| 17                | Shaft                   | 1   | An aluminum pipe                   | welded to be a shaft                          | Aluminum | D=0.5" , L=48"     | \$19.99         | Amazon                |
| 18                | Blower pulley           | 1   | A pulley made from steel           | Pulley to help turn the V-belt                | Steel    | 10 x 1 "           | \$13.78         | Hom Depot             |
| 19                | Motor Pulley            | 1   | A pulley made from steel           | Pulley to help turn the V-belt                | Steel    | 3-1/4 x 1/2        | \$9.88          | Hom Depot             |
| 20                | V-Belt                  | 1   | Made from rubber                   | Help transfer the energy or mechanism         | rubber   | 69"                | \$5.78          | Hom Depot             |
| 21                | Galv roll               | 1   | A roll of steel                    | In order to create the spring inside the gear | Steel    | 8" x 10'           | \$13.34         | Hom Depot             |
| 22                | F-150                   | 1   | Will be chopped down to meet needs | To help make the base                         | Wood     | 1" x 4' x 8'       | \$23.00         | Hom Depot             |
| 23                | Melamine White Pannel   | 2   | Helps fitting through cutting      | Cut it down to create the base                | wood     | 75" x 48"          | \$33.84         | Hom Depot             |
| 24                | White PEX Pipe          | 1   | Works as rods                      | They are going to help move the wings         | Plastic  | 3/4" x 5'          | \$3.26          | Hom Depot             |
| 25                | PEX Pipe                | 1   | Works as rods                      | To connect to timing pulleys                  | iron     | 1/2" x 5'          | \$1.86          | Hom Depot             |
| 26                | Aluminum Flashing       | 1   | A roll of Aluminum                 | Help make a spring compared to the steel      | Aluminum | 6" x 25'           | \$12.58         | hom depot             |
| 27                | Center snips            | 1   | Tool for pipes                     | Cuts down the pipes to required sizing        | Steel    | No                 | \$9.97          | Hom Depot             |
| 28                | 3-D Gears               | 2   | Source of mechanism                | rotates energy                                | PLA      | D=6" , L=2.25"     | \$42            | Makerlab              |
| 29                | 3-D Gears               | 2   | Source of mechanism                | rotates energy                                | PLA      | D=3.5" , L=2"      | \$19.35         | Makerlab              |
| 30                | 3-D Gears               | 1   | Source of mechanism                | Ratchet Gear needed for spring                | PLA      | D=7" , L=3.5       | \$66.21         | Makerlab              |
| 31                | 3-D Gears               | 2   | Source of mechanism                | rotates energy                                | PLA      | D=2" , L=1.5"      | \$9.38          | Makerlab              |
| 32                | 3-D Gears               | 2   | Source of mechanism                | rotates energy                                | PLA      | D=6" , L=2.5"      | \$51.63         | Makerlab              |
|                   |                         |     |                                    |   |          |                    | \$419.84        |                       |
|                   |                         |     |                                    |   |          |                    | <b>\$491.21</b> | <b>= Total Cost</b>   |

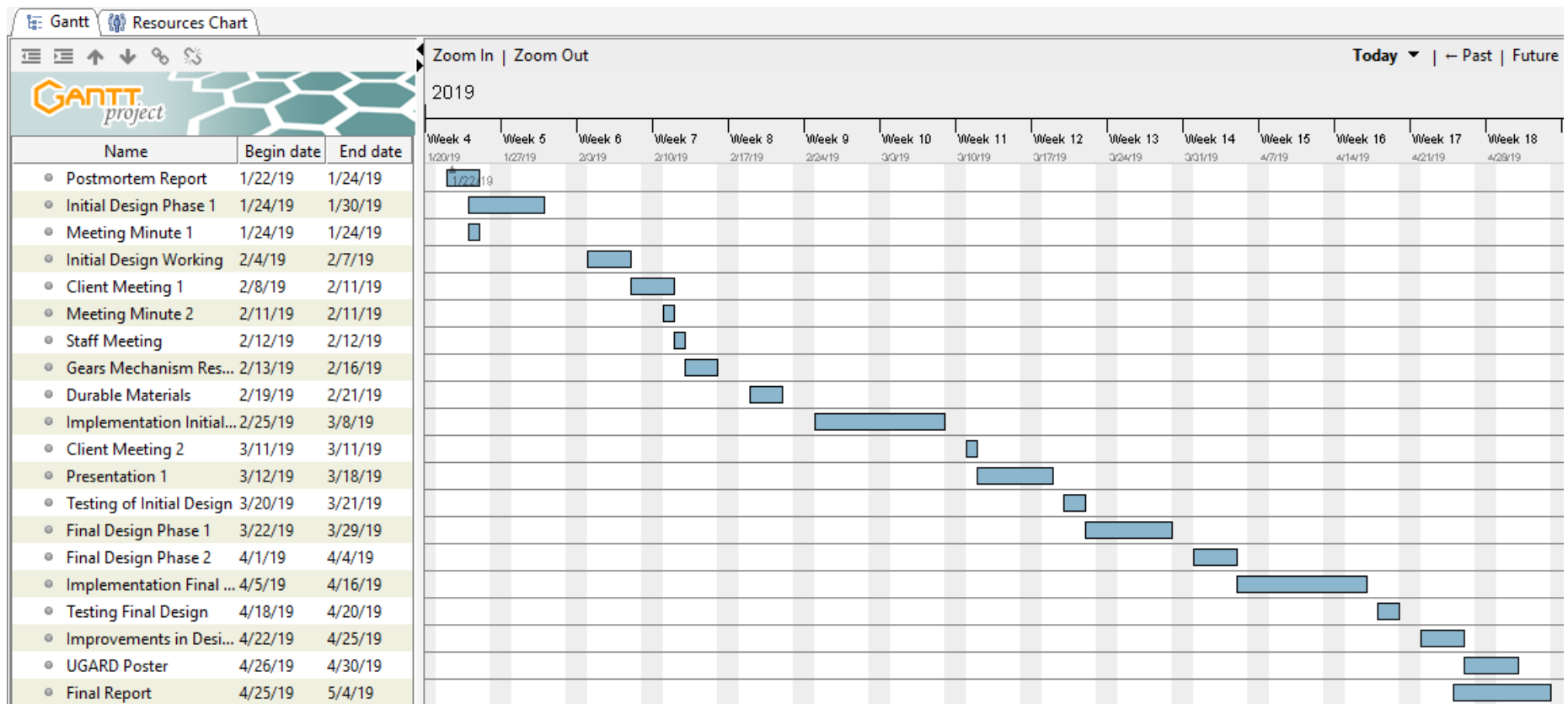
# Current Valid Parts From BOM



# Schedule and budget

- ▶ A schedule has been defined in the form of Gantt chart
- ▶ It describes and show the timeline from starting time till the ending time.
- ▶ The Gantt chart is a process of helping us track our achievements and what we have to accomplish within a time span provided based on due dates.

# Gantt Chart





# Budget

| Budget Description   | Price    |
|----------------------|----------|
| Total Budget         | \$1300   |
| Anticipated Expenses | \$1000   |
| Actual Expenses      | \$535.38 |
| Remaining Budget     | \$764.62 |

# Conclusion

## ▶ Conclusion

- Team is working on the project manufacturing the Kinetic Sculpture
- Customer requirements so far has been fulfilled
- CR's and ER's have been checked throughout the building process
- Our final design is being manufactured
- Final design settled from previous semester have not changed but, extra calculations and items have been added
- Technical Analysis has been done by each member in depth to help the process
- Final CAD model is in process
- Bill of Materials has been updated
- Gantt chart has been updated
- Budget has been updated
- Behind schedule due to printing errors from the NAU maker lab and devices shut down

## ▶ Future Work

- Manufacturing the other 60% of Project
- Hardware review II

# References

1. Chau, C., 2017. Systems Aesthetics: A key polemic in contemporary kinetic art history. In *Movement, Time, Technology, and Art* (pp. 57-73). Springer, Singapore.
2. Chen, G.D., Lin, C.W. and Fan, H.W., 2015. The history and evolution of kinetic art. *International Journal of Social Science and Humanity*, 5(11), p.922.
3. Li, B., Mooring, J., Blanchard, S., Johri, A., Leko, M. and Cameron, K.W., 2017. A kinetic parallel computer sculpture for educating broad audiences on parallel computation. *Journal of Parallel and Distributed Computing*, 105, pp.183-199.
4. Wilson, E., 2018. 'Diagrams of motion': Stop-motion animation as a form of kinetic sculpture in the short films of Jan Švankmajer and the brothers quay. *Animation*, 13(2), pp.148-161.
5. McMaster.com. (2019). *McMaster-Carr*. [online] Available at: <https://www.mcmaster.com/bevel-gears> [Accessed 6 Mar. 2019].

# Questions?