



Artimedes: A Kinetic Sculpture

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Project Description

- The goal was to create a kinetic sculpture that utilizes at least 3 engineering principles
- Client: Dr. Sarah Oman
- Stakeholders: current and future students/faculty



Figure 1: Duality by David Roy [1]



Project Description (cont'd)

- The sculpture will be displayed in the engineering building
- Purpose is to entice potential college students in pursuing a career in engineering
- Inspired by combining art and engineering



Figure 2: Di-Octo by Anthony Howe [2]

Requirements and Specifications

Table 1: Requirements and Specs for Final Design

Requirements	Specifications
Easily Transportable	Easily moved by 2 people Less than 150 lbs Fit through a door
Cost Effective	Budget of \$2000
Represent Engineering in a positive way	Demonstrate at least 3 engineering principle
Aesthetically Pleasing	9/10 will enjoy and appreciate
Safety	No one can hurt themselves while using the sculpture
Durable	Must last multiple years in the engineering building

Initial Plans

- 3D printed prototype
- Gear train drives the worm gear
- Ring gear is 16 inches in diameter

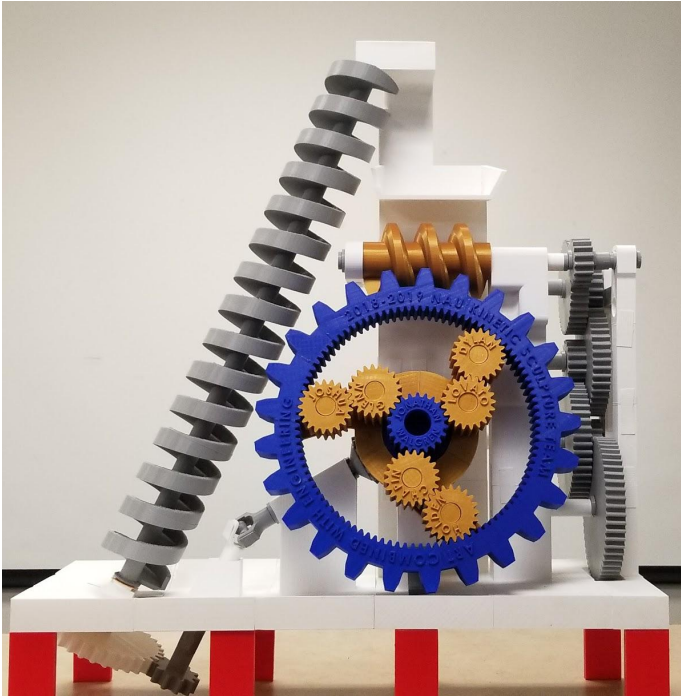


Figure 3: 3D Printed Prototype



Initial Plans (cont'd)

- Melt and sand cast aluminum cans
- Ring gear, sun gear, planetary gears were to be casted
- Crucible failure led to redesign



Figure 4: Foundry Built by Team



Figure 5: Exploded Crucible



Figure 6: Molten Aluminum in Crucible



Design Changes

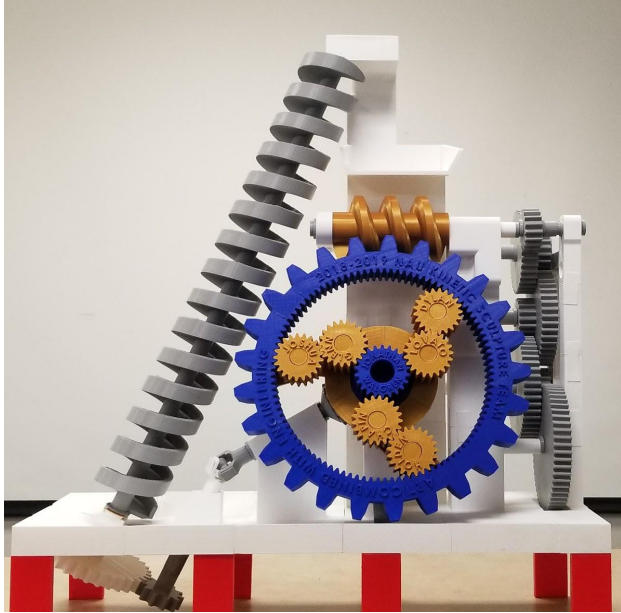


Figure 7: 3D Printed Prototype

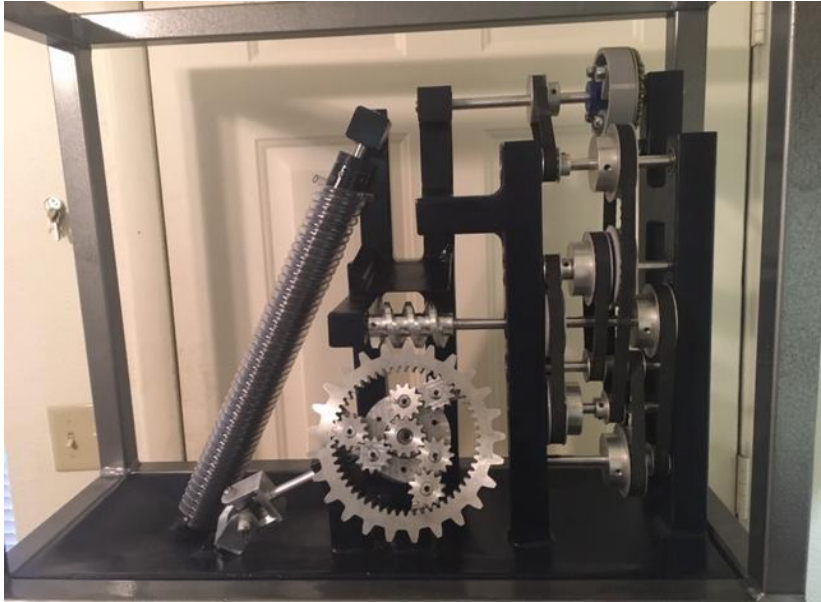


Figure 8: Final Design



Design Details

- Hand crank allows for an interactive sculpture
- Modified trailer winch



Figure 9: Hand-Crank



Design Details

- Utilizes timing belts for control of speed of gear sets
- Ratio of 1.31:1



Figure 10: Timing Belts



Design Details

- Planetary gear set driven by worm gear
- Planetary gear set:
 - Centrally located sun gear
 - Planetary gears revolve around sun gear
 - Ring gear encases planetary gears

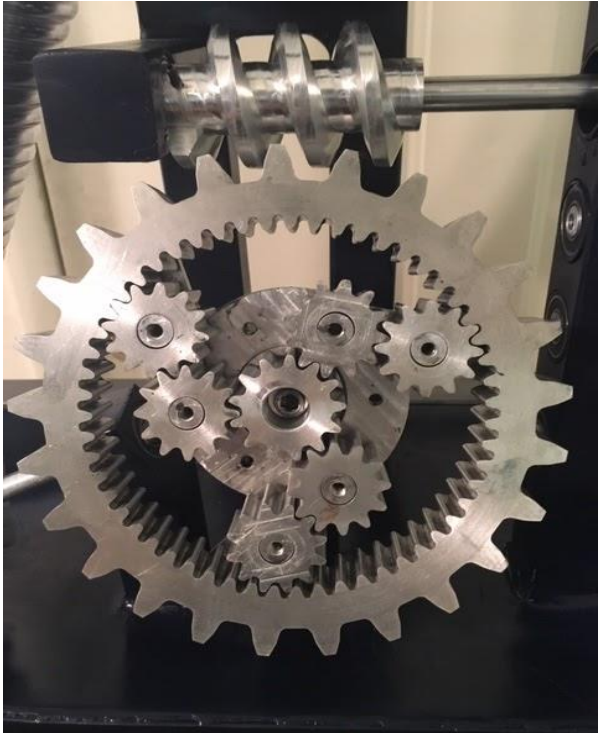


Figure 11: Main Gear Set



Design Details

- Bevel gear machined on back of planetary gear set

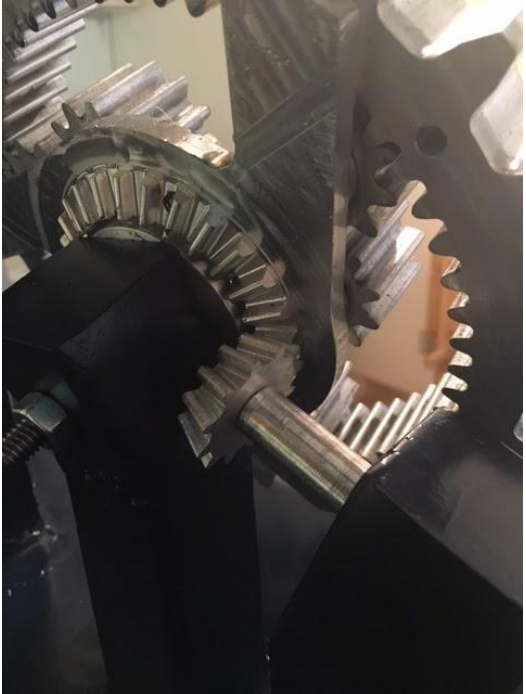


Figure 12: Bevel Gear Driving U-Joint



Design Details

- U-Joint connects the gear set to the Archimedes screw

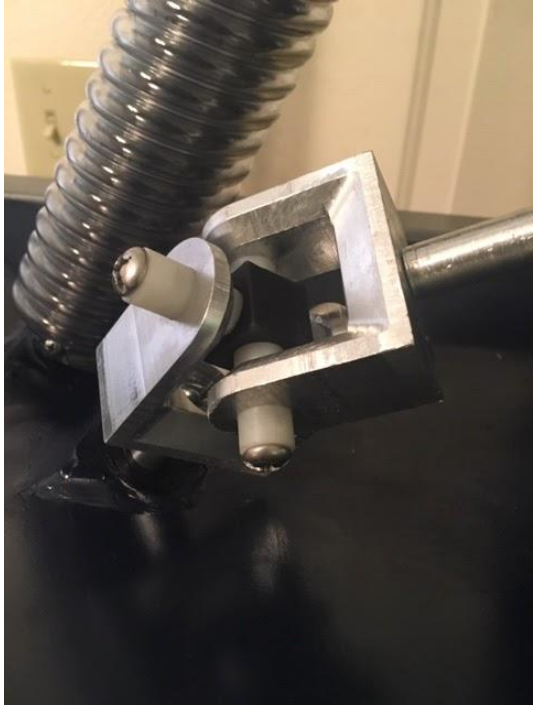


Figure 13: U-Joint



Design Details

- Archimedes screw lifts oil up to the shelf which lubricates the main gear set

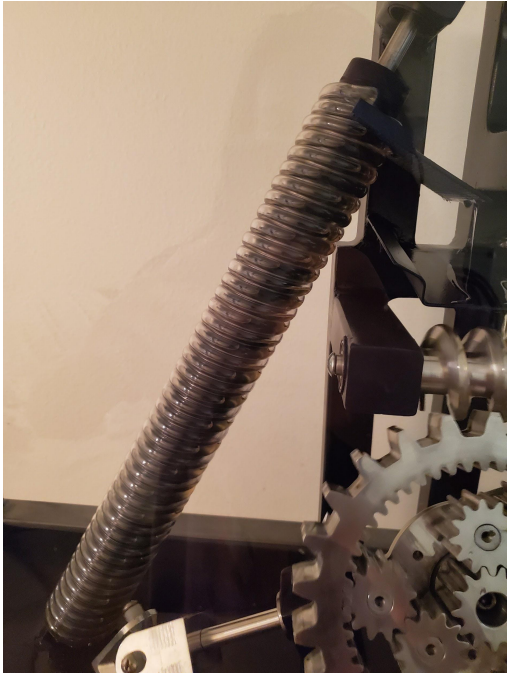


Figure 14: Archimedes screw



Meeting Requirements

Table 2: Requirements and Results

Requirements	Results
Easily Transportable	Created a stand with wheels for easy transportation
Cost Effective	Final product cost less than \$1500
Represent Engineering in a positive way	Archimedes Screw, 6 Gear Types, Timing Belts, Cons. of Energy, Metal Casting
Aesthetically Pleasing	Received only compliments on the appearance of the final design
Safety	The sculpture is encased in plexiglass
Durable	The oil lubricates the main gear set. Sculpture should last 15,000+ cycles

Manufacturing

- Structure is made from 1.5" x 1.5" Steel Square Tubing
- Bulk aluminum was purchased and machined by a CNC mill
- Archimedes screw was created using plastic tubing, PVC, and A steel shaft

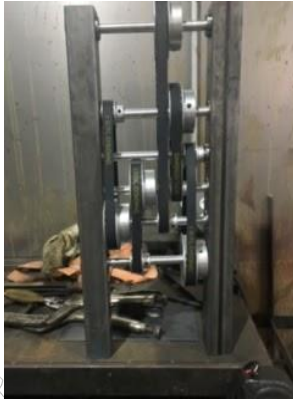


Figure 15: Timing Belt Assembly



Figure 16: Planetary Gear Set Assembly



Figure 17: Sculpture Body Assembly



Figure 18: Sculpture Stand Assembly



Testing Procedures

- To test the sculpture we have run the sculpture for a total of 3,600 cycles of the ring gear in the main gear set
- Ran the system with the worm gear at 1500 rpm
 - Normal speed is 50 rpm

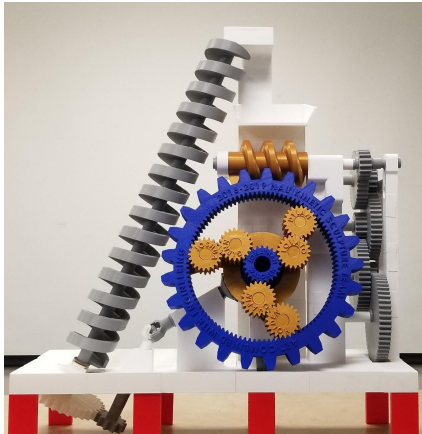


Figure 19: Initial Plan/ 3D Printed Prototype

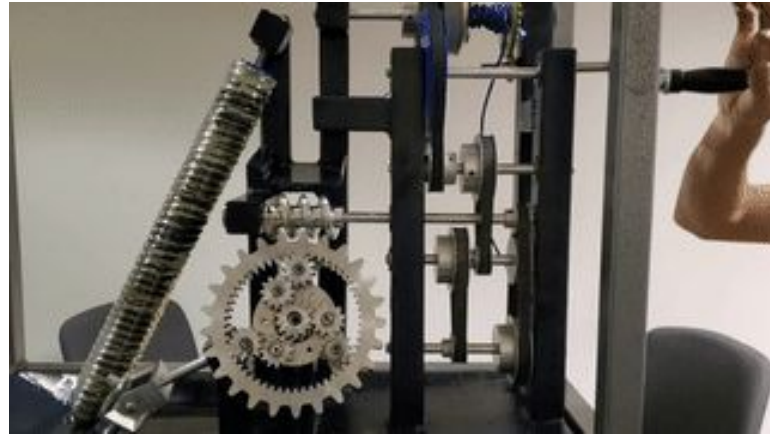


Figure 20: Kinetic Sculpture in Motion

Final Outcome

Jonathan Walgren
April 26, 2019
Kinetic Sculpture

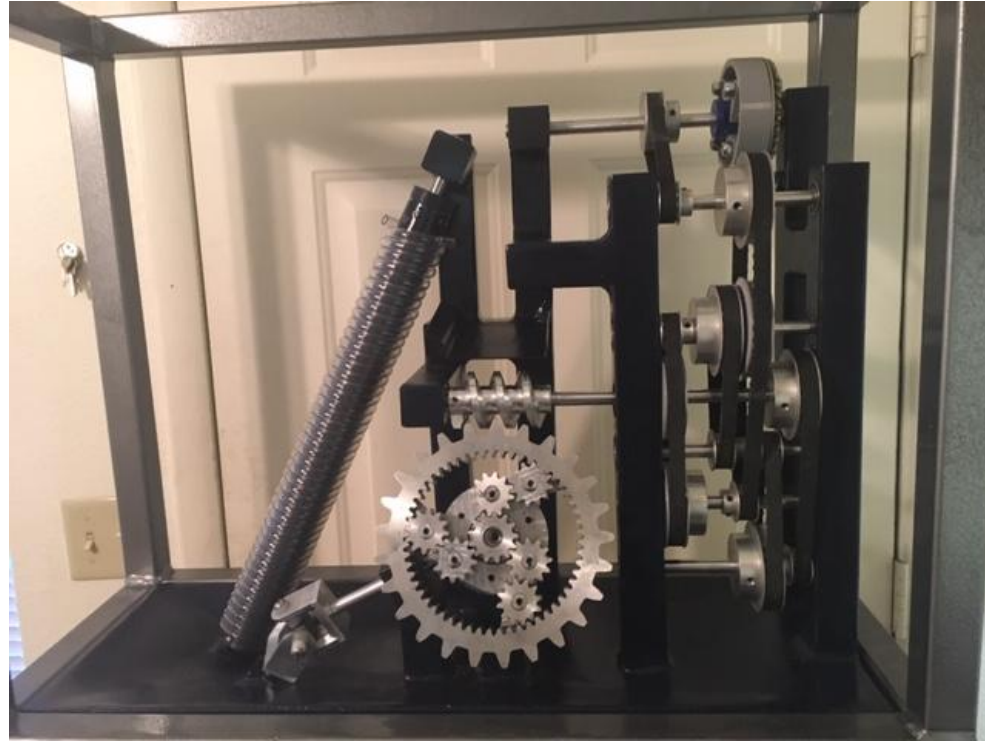


Figure 21: Artimedes - A Kinetic Sculpture



Final Outcome

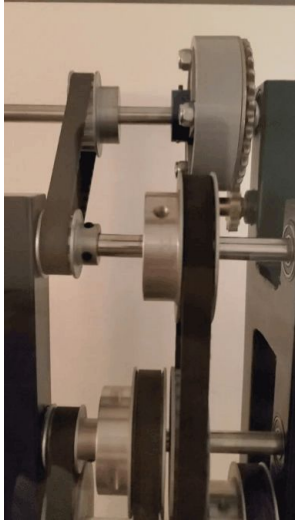


Figure 22: Final Timing Belt Orientation in Motion



Figure 23: Main Gear Set in Motion



Figure 24: Archimedes Screw Dropping the Oil



Thanks & Sponsors



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FUND



Special Thanks To:

Dr. Sarah Oman, Kay Pinto, Singne Slayton, Dr. Jennifer Wade

References

[1] “r/woahdude - Duality kinetic sculpture (David C. Roy),” *reddit*. [Online]. Available:

https://www.reddit.com/r/woahdude/comments/98ln6h/duality_kinetic_sculpture_david_c_roy/. [Accessed: 26-Apr-2019].

[2] Shovava and Shovova, “Art History: The Evolution of Hypnotic Kinetic Sculptures,” *My Modern Met*, 03-Oct-2017. [Online].

Available: <https://mymodernmet.com/kinetic-sculpture-art-history/>. [Accessed: 26-Apr-2019].

Questions?

