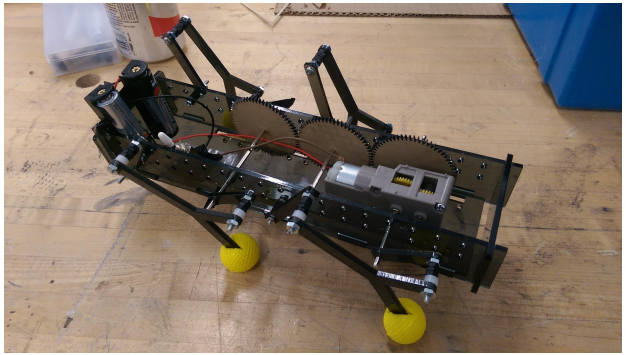


The G.O.A.T

Jens Andersen, Rit Bezbaruah,
Raul Martinez, and Mickey Velado

Biological Inspiration (Item 1)

Goat chosen as model for stability

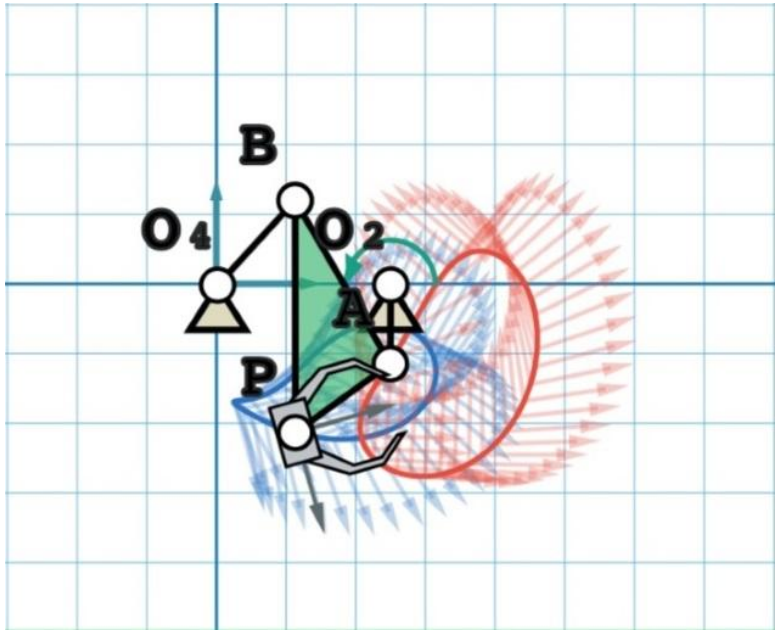
http://www.west-crete.com/dailypics/crete-2010/12-2-10.php

“Gary the Goat” running next to a car

https://youtu.be/GUNMBw6p73k?t=10s

Biological Inspiration (Item 1)

MotionGen Curve (in blue)



Grashof Crank-Rocker

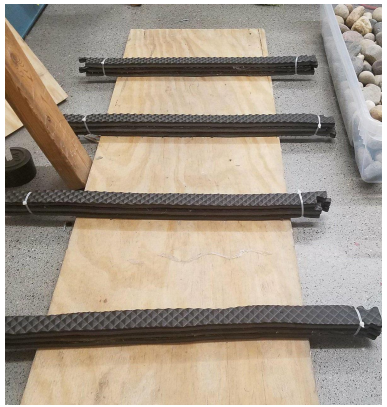
“Gary the Goat” running next to a car

https://youtu.be/GUNMBw6p73k?t=10s

Obstacle Course Coefficients (Item 2)

Stairs: 0.49

Hurdles: 0.73



Rocks: 1.78

Design was optimized for rocks, but created coupler curve to ensure it cleared the 1.5” tall hurdle

Coupler Curve Details (Item 2)

Link Lengths:

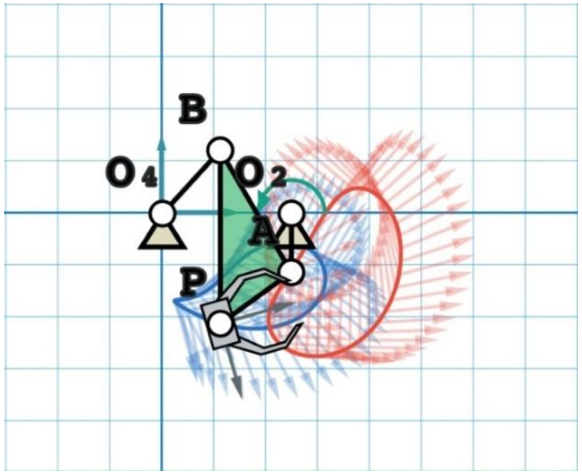
Link	Name	Length
O2O4	Ground Link	2.4838
O2A	Crank	1.1309
O4B	Follower	1.6459
AB	Coupler Fixed Length	2.7127
AP	Coupler Arm Length	1.6825

Link Angles:

Angle	Description	Value (degrees)
O4O2A	Crank Angle	89.67
O2O4B	180 - Follower Angle	312.51
PAB	Coupler Arm Angle	95.61
-	Crank End Effector Angle (Global Coordinates)	285.94

Long stride for **reach** and **stability**

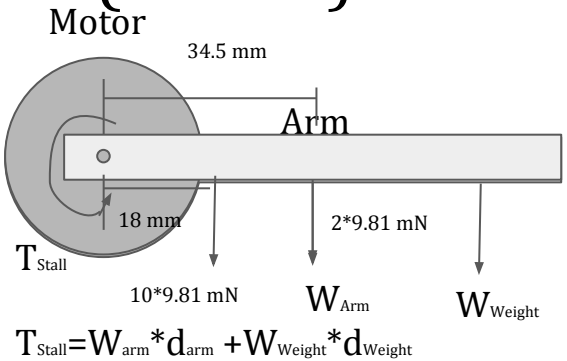
High stride for **climbing**



Stall Torque Measurements and Gears (Item 3)

Stall Torque Measurement Procedure:

- Measure mass of acrylic arm
- Clamp motor to table
- Set arm on shaft
- Hang 10g weight at the end
- Check if motor stalls and holds up weight
  - If not, move weight further up arm and repeat



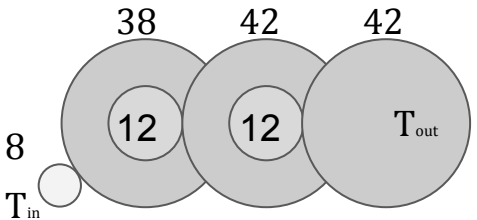
$$T_{Stall}=W_{arm}*d_{arm}+W_{Weight}*d_{Weight}$$

Calculated Stall Torque: 0.346 oz - in

- Tamiya Torque: 0.50 oz - in

Gear Ratio:

- Gearbox: **Medium** (MA = 931/16 ≈ 58)
  - Chosen for a balance of torque, stability, and speed
  - T_{out}=20.1 oz - in
- Outer: 1:1
  - Legs must remain in sync



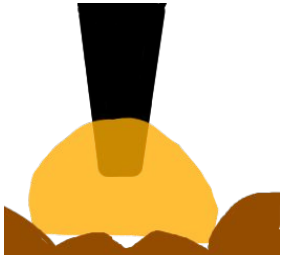
$$MA = \frac{38}{8} * \frac{42}{12} * \frac{42}{12} = \frac{931}{16}$$

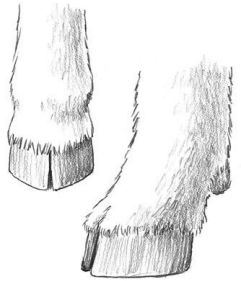
Foot Designs (Item 3)

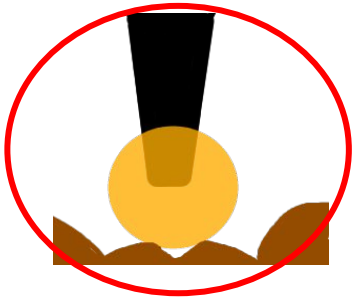
Hoof
- Contact somewhat dependent on leg angle
- Stable both statically and dynamically
- Complicated geometry, difficult to manufacture

Spike (or absence of foot)
- Contact very dependent on leg angle
- Dynamically unstable
- May get stuck between small rocks
- Lightweight and simple to manufacture

Sphere
- Contact largely independent of leg angle
- Stability dependent on size
- May slide or deform







Coefficient of Friction (Item 3)

Coefficient of Friction Estimation:

- Simple beam-on-gear model to relate torque and friction
- Weight and leg length *L* estimated from physical measurements and CAD simulation

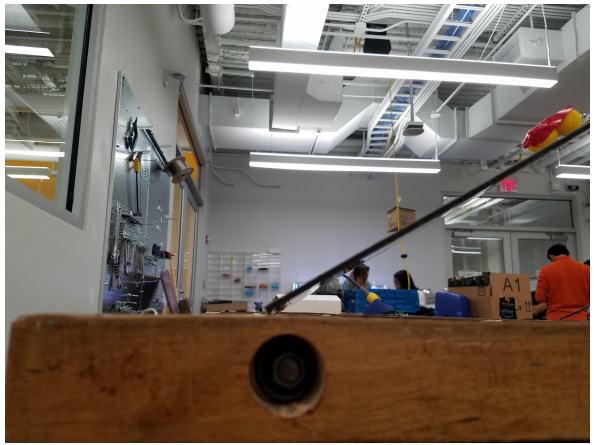
From statics:

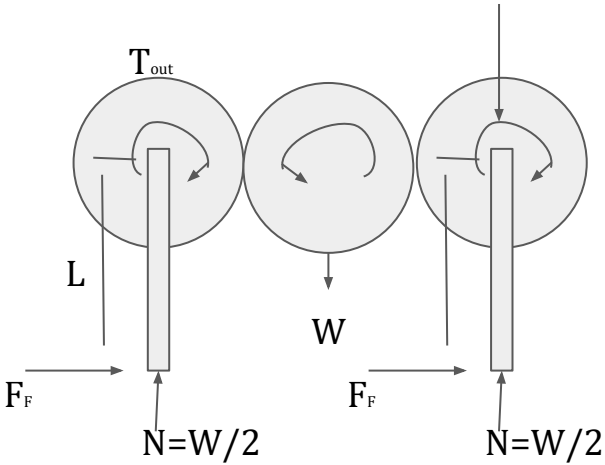
$$\mu_{max} = \frac{T_{out}}{wL}$$

μ_{max} =0.747

Inclined plane test

μ_{sphere} = 0.538





Team Organization by Area (Item 4)

Area	**Contributors**
Animations/Video	Jens
MotionGen coupler curve	Jens, Raul
Stall torque calculations	Rit, Jens, Mickey
Gear ratio calculations	Jens, Rit
Coefficient of friction calculations	Rit, Jens
CAD model	Raul
Laser Cutting	Raul
Acquisition of construction materials	Mickey, Rit, Jens
Physical assembly	Raul, Rit, Jens, Mickey
Troubleshooting	Raul, Mickey, Rit, Jens
Presentation editing	Jens, Raul, Rit, Mickey

To Do and Demo (Item 4)

Tasks that need to be completed:

- Legs need to be moved further apart
  - Redo base and gears
- Screws need to be secured in place
- Possibility of different leg or foot design
- Link lengths