Replicating the Function and Speed of a Chameleon's Tongue

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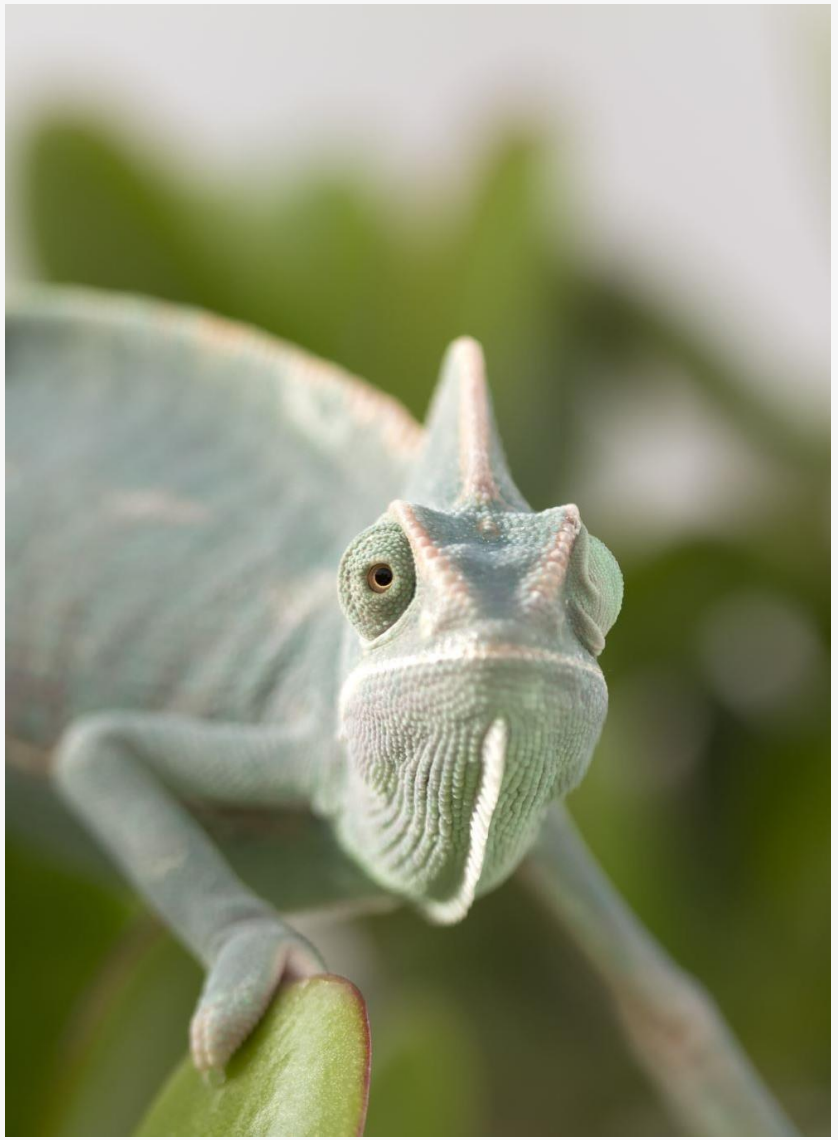


Project Description

Project Title: Chameleon’s Tongue

Project Sponsor: Pranav Bhounsule

Professor Bhounsule is the Head of the UIC Robotics and Motion Laboratory

ROBOTICS AND MOTION LABORATORY

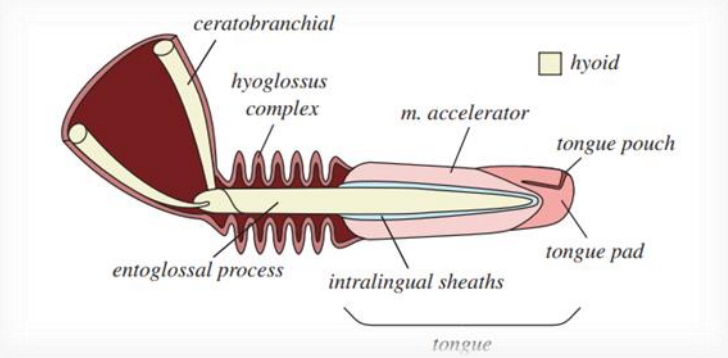
- The goal of this project is to create a contraption for high-speed snatching inspired from the chameleon’s tongue
- A high-speed snatching mechanism and a retrieval mechanism combined into one design
- Replacing bulky robotic arms that limit productivity in the manufacturing and packaging industry

Our Goal

- To create a device that replicates the motion of the chameleon’s tongue
- To effectively use our budget to achieve the highest exit velocity
- Keep our design within industry codes and the relative size of a chameleon

Chameleon’s tongue and its motion:

- In short, the tongue is comprised of two main muscle structures, one to extend and one to contract
- The end of the tongue has been adapted over centuries to capture prey using it surface texture and interior muscles



Debray, A., “Manipulators Inspired by the Tongue of the Chameleon,” Canon Incorporation, Biophysical Society, March 2011.

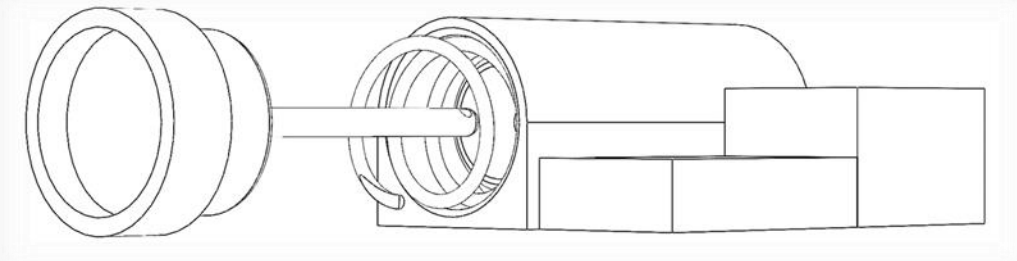
Proposed Solution

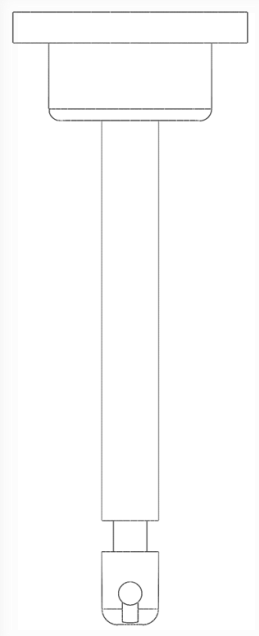
A linear compression spring powered launcher that launch the projectile out and a motor system that will retract the projectile connected via a string

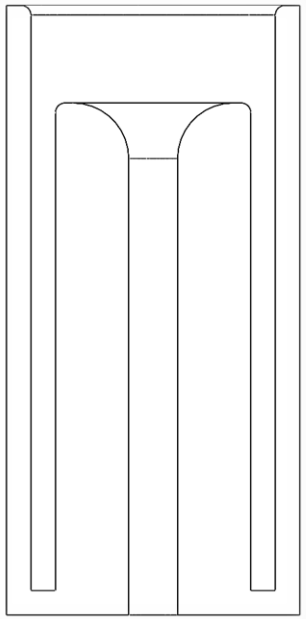
Top: Full design with electronic boxes

Left: Projectile

Right: Body Cylinder



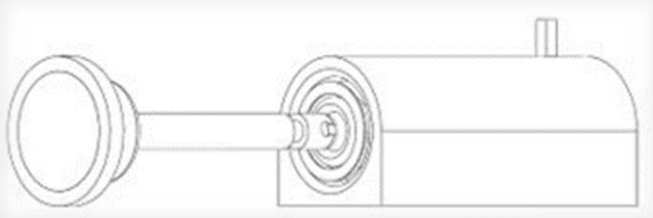




Our First Prototype

Initial prototype

Real life picture of our first prototype



Observations

- This design was printed and evaluated to determine if the design would function smoothly
- It showed that the design would work well with a small amount of post processes work
- The electrical components were ignored for this prototype to speed print time

Our Second Prototype

Design Changes

- Scaled up our design to fit the chosen spring
- Substituted the 3D printed trigger pin for a metal pin for more durability
- More post processes to achieve a lower friction coefficient
- The projectile was printed with varying compression lengths to achieve different velocities

Resulting Exit Velocity

- With the 0.5 inches of compression, our design achieved 4.5 meters per second
- With the 1.0 inches of compression, our design achieved 10 meters per second
- The chosen spring had the following specifications

Length	3"
OD	1"
ID	0.76"
Wire Diameter	0.12"
Compressed Length @ Maximum Load	1.97"
Maximum Load	47.34 lbs.
Spring Rate	46.04 lbs./in.

Images of Our Second Prototype

Our Final Prototype

Design Changes

- Scaled up our design to fit the chosen spring
- More post processes to achieve a lower friction coefficient
- Higher percent infill to strengthen components

Resulting Exit Velocity

- With the 1.0 inches of compression, our design achieved … meters per second
- The chosen spring had the following specifications

Part Number: LHC 207U 08M

Series:	Heavy Duty Series (inch)
Outside Diameter (inch):	1.937
Hole Diameter (inch):	2
Rod Diameter (inch):	1.472
Free Length (inch):	6
Rate (lb/inch):	54.7
Solid Height (inch):	2.343
Wire Diameter (inch):	0.207

Images of Our Final Prototype

Evaluating Our Final Design

Theoretical Achievements

Potential Industry Applications

By developing the launching and recoiling mechanisms of our design, it can potentially be used for ...

- Grab parts off an assembly line
- Sort parts into corresponding areas
- Children’s toys

Acknowledgements

We would like to first thank our project sponsor professor Bhounsule for providing us guidance and allowing us to have broad approach at replicating the natural movements of nature.

We would also like to thank ...

We would also like to thank our project advisor professor Komperda for guiding us weekly as to where we should be heading and what still needs to be done.

Lastly, we would like to thank ...