TENSEGRITY INTERNAL ACTUATION

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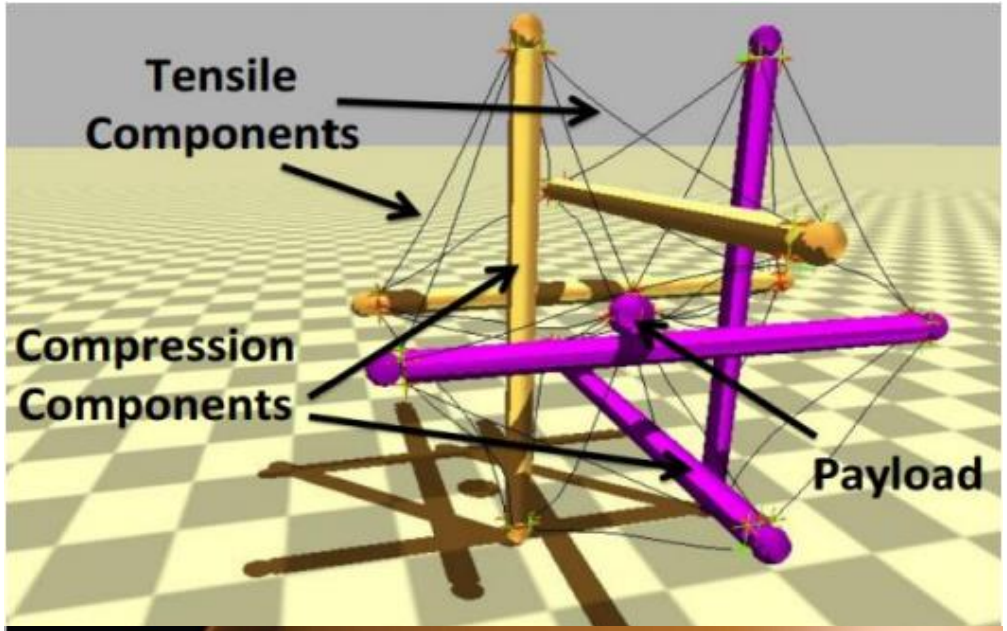
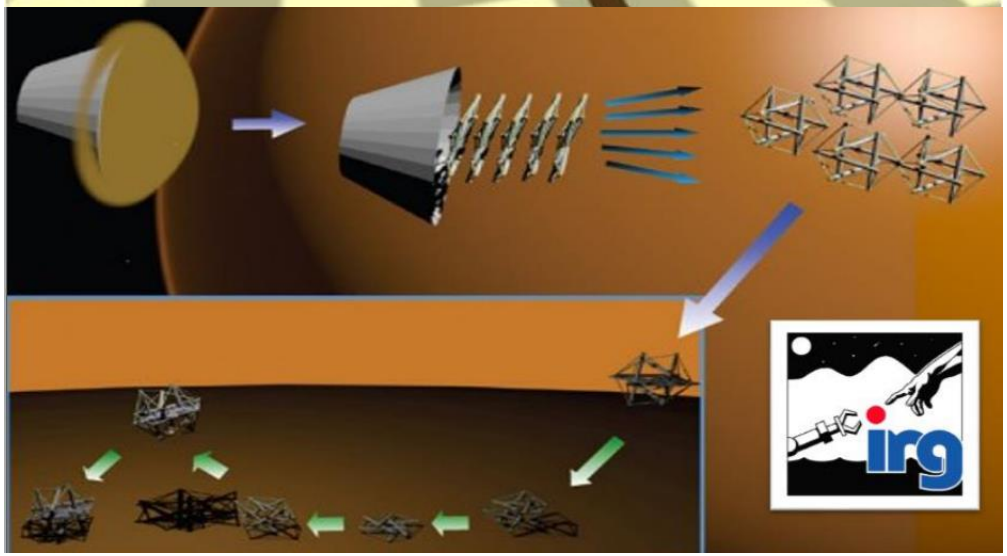
BACKGROUND & MOTIVATION

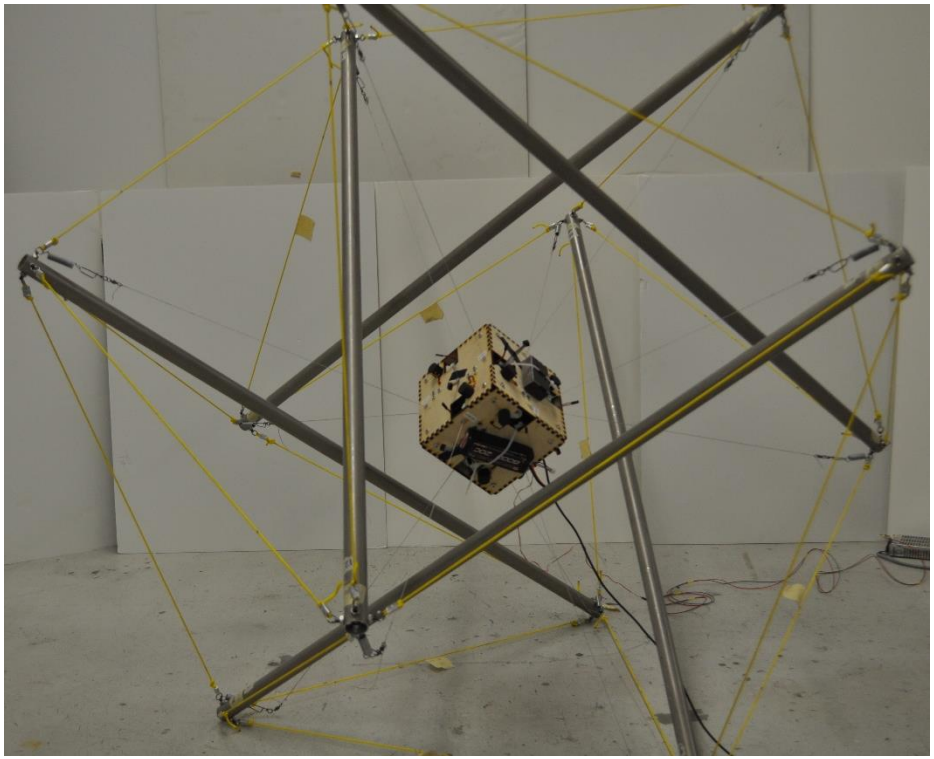
- Tensegrity – tensile integrity
- Space exploration
- Benefits
  - Light weight
  - Low cost
  - Lander and rover
- Locomotion
  - External actuation
  - Internal actuation



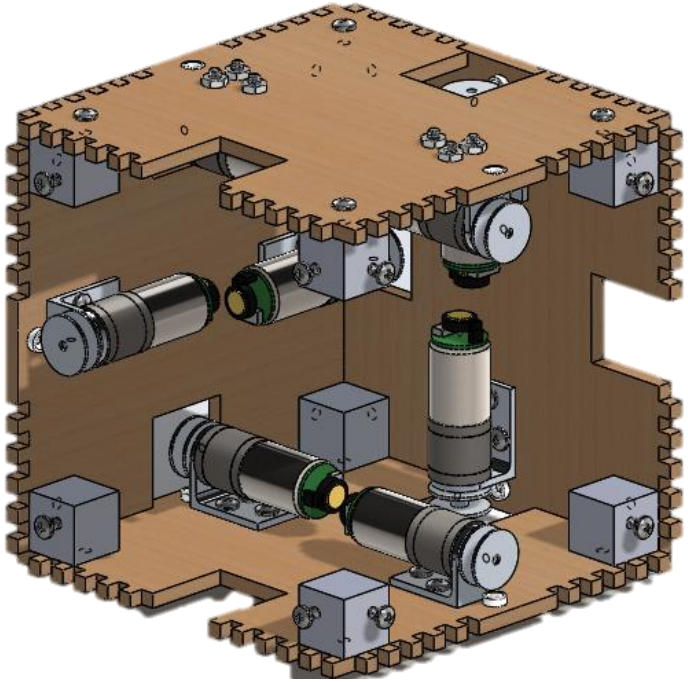


PROJECT GOALS

- Develop first prototype payload
  - Structure
  - Actuators
  - Sensing
  - Control system
  - Power source
- Investigate payload actuation and structure locomotion
  - Cable routing
  - Tipping sequences
    - Isosceles face
    - Equilateral face

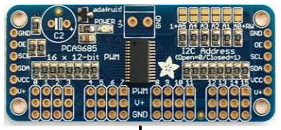


PAST DESIGNS

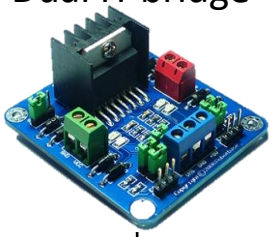


Teensy 3.1

PWM driver



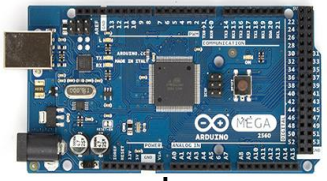
Dual H-bridge



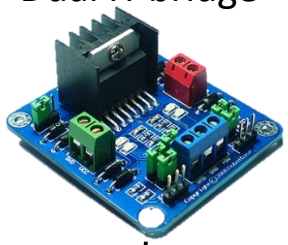
DC motor

Encoder

Arduino Mega



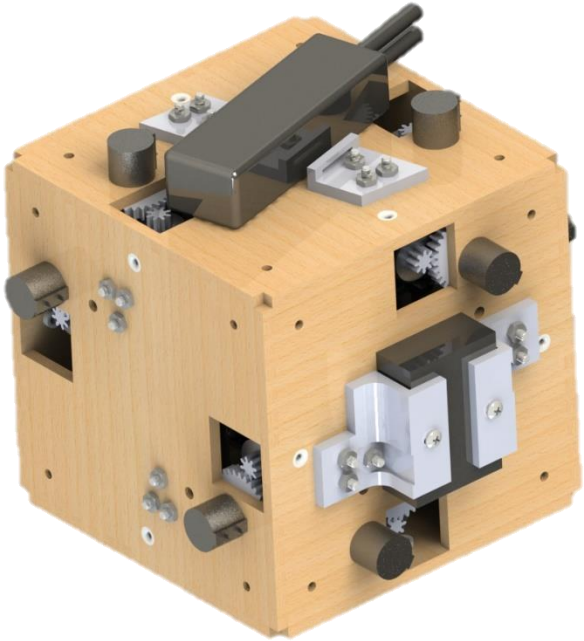
Dual H-bridge

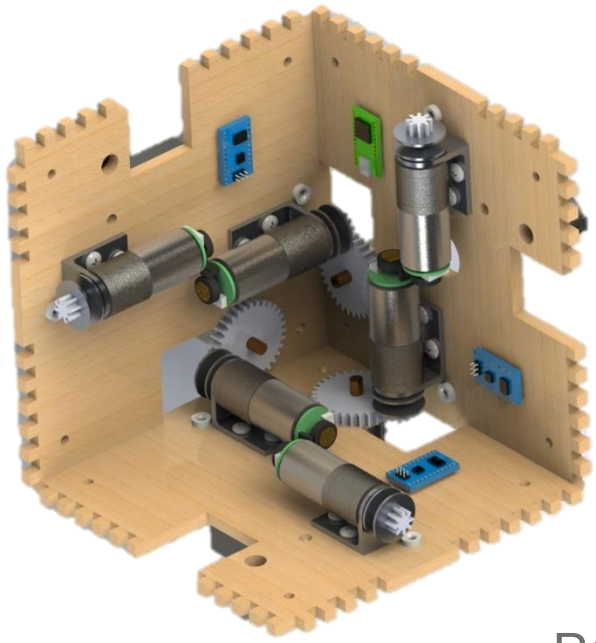


Brushed DC motor

Geared 10-turn pot

STRUCTURE





Payload mass – 3 kg

Battery mass – 0.4 kg

Sci. mass – 2.6 kg

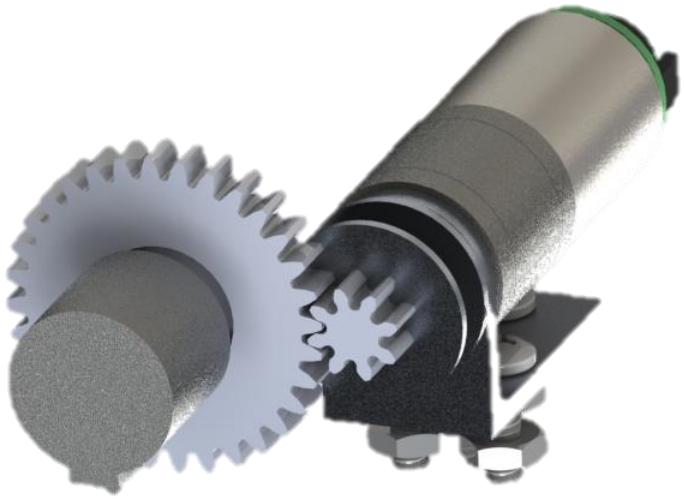
ACTUATION AND SENSING

Position sensing

- 4:1 Geared 10-turn potentiometer
- Absolute
- Requires less calibration

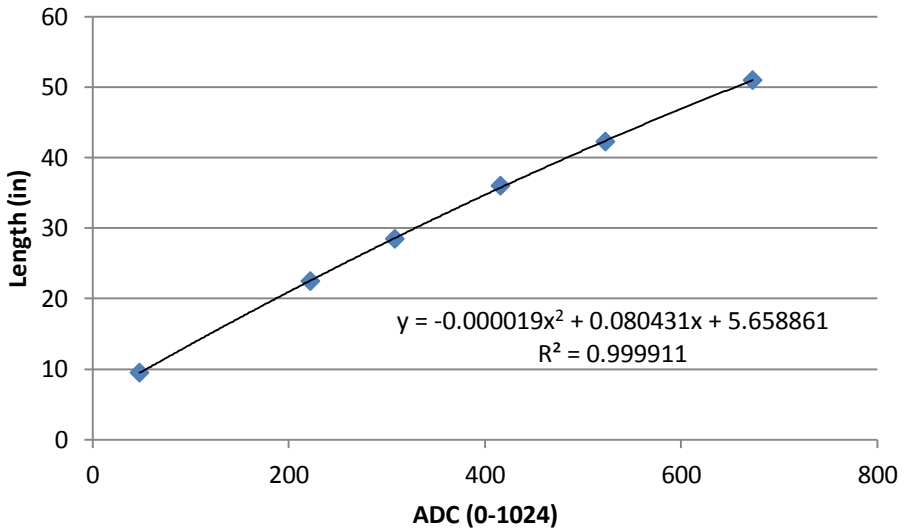
Orientation sensing

- 3 axis accelerometer
- Mounted on frame
- Mount gets in the way of cable routing
- Currently not implemented



CALIBRATION

- Individual calibrations
- Daily check and recalibrate
- Causes of errors
  - Improper spooling
  - Potentiometer drift
  - Added springs to ends of cables



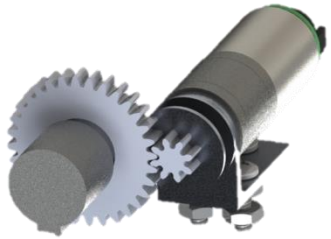
CONTROL SYSTEM

- 1 – Teensy microcontroller
- 6 – Baby Orangutan motor controllers
- 12 DC motors – 2 per Baby Orangutan
- 12 Geared potentiometers

Teensy 3.1

Baby Orangutan controller (x6)

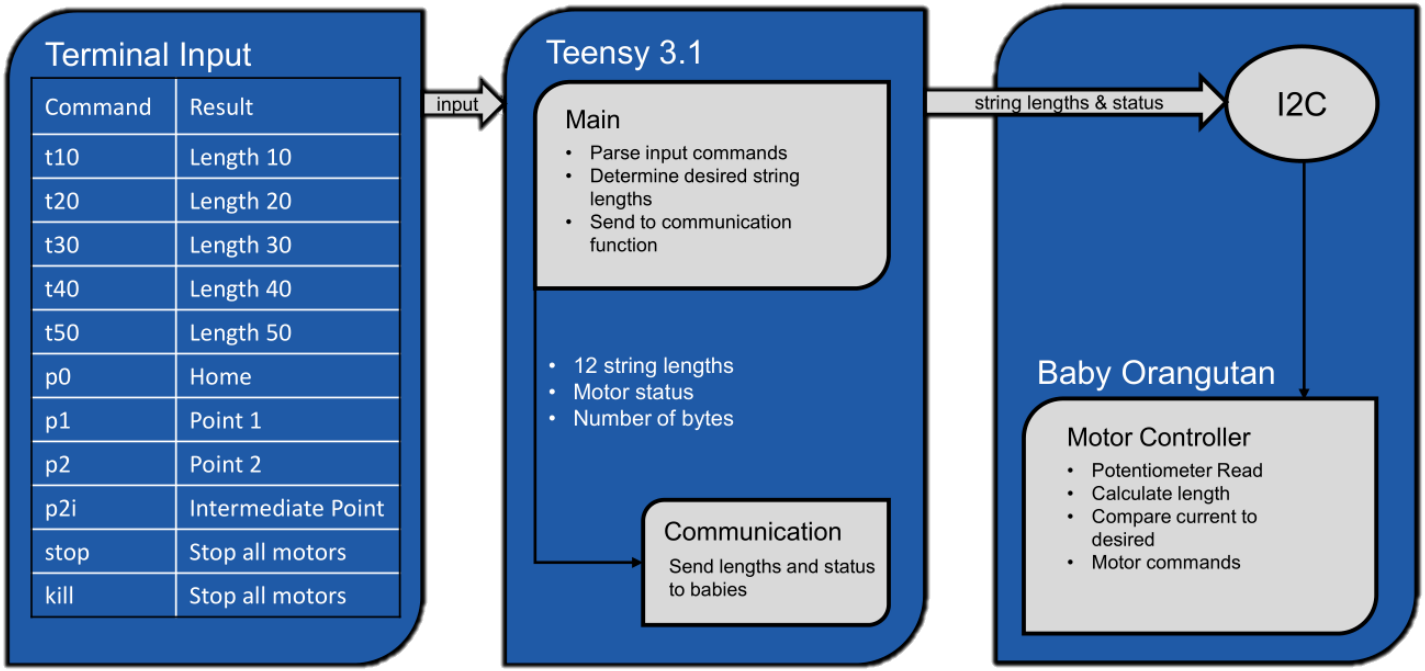
DC motor



(x12)

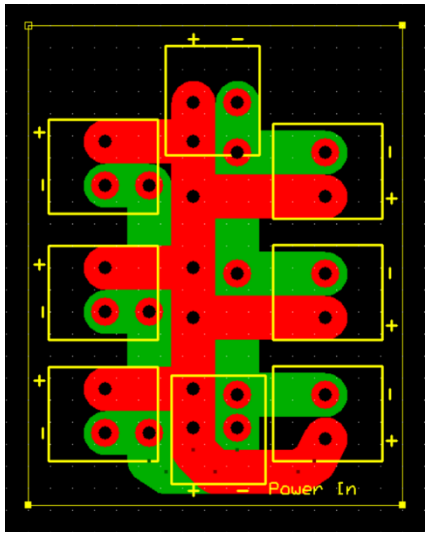
Geared potentiometer

SOFTWARE ARCHITECTURE



POWER SOURCE

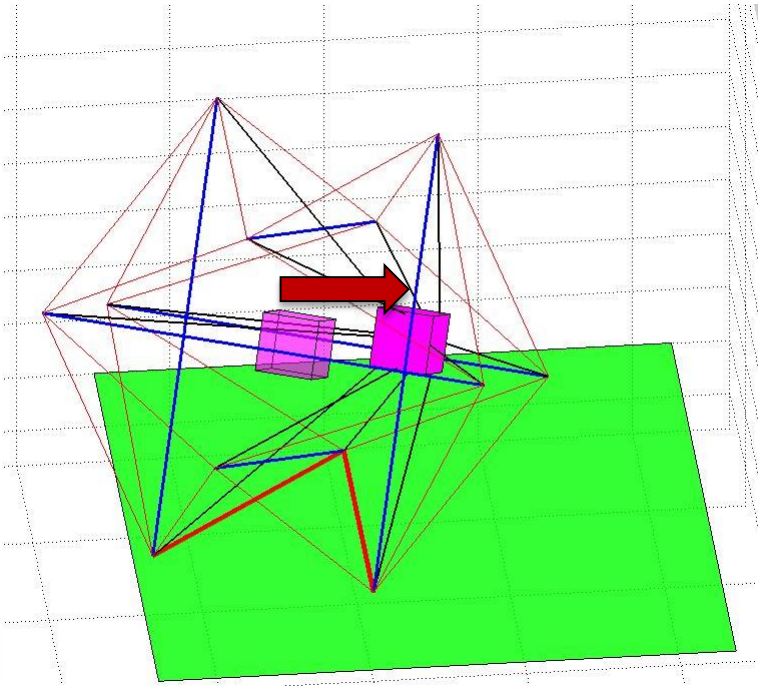
- 7.4V Lithium-ion Polymer Battery
  - Approx. 1 hour 20 min battery life



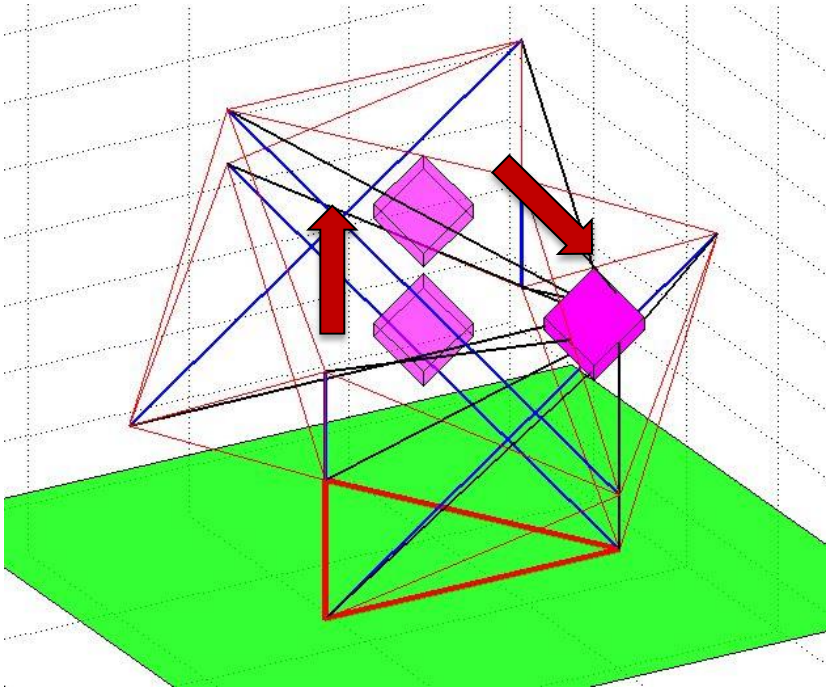
- PCB with terminal to distribute power from battery
  - 1 block for battery input
  - 6 blocks for output to Baby Orangutan controllers
  - 1 output to monitor battery voltage on Teensy controller.

MODELING AND TESTING

Isosceles base



Equilateral base



NASA VISIT