Multifunctional Mobile Robot

ASME Student Design Competition

Motivation

The 2016-2017 ASME Student Design Competition requires a design of a multi-functional, mobile robot capable of lifting, throwing, and hitting an object while still maintaining a high degree of mobility and abiding by any constraints placed by the competition committee.

The goal of the design team is to outperform all competitors through superior organization, dedication and engineering, and to ultimately win the competition.

Competition Scope

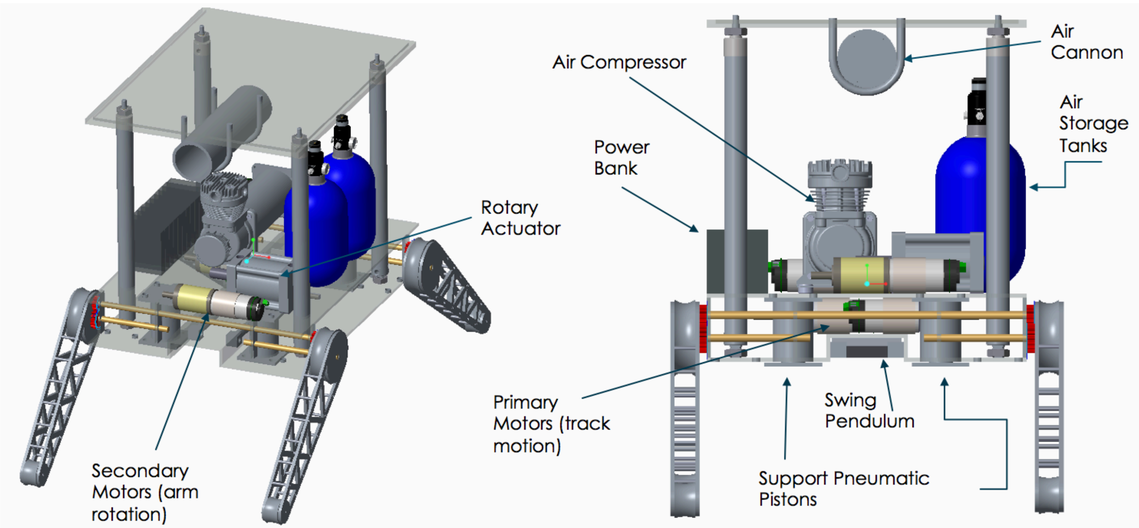
The robot must compete in five separate events:

- **Sprint** – Touch a wall 10 meters away and return to start
  - Score based on time
- **Throw** – Launch a tennis ball along an axis
  - Score based on distance
- **Climb** – Climb and descend a set of three steps
  - Score based on time
- **Lift** – Lift a weight vertically
  - Score based on mass and distance of object lifted
- **Hit** – Hit a golf ball from the ground
  - Score based on distance and accuracy along axis

Constraints

- All components must fit within a 50cm x 50cm x 50cm sizing box
- All stored energy such as springs and compressed air used in the competition must be conservable and restored to its original form by the end of each event

Design



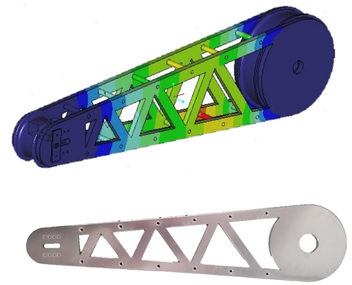
Design Approaches

- **Sprint**: Extending Arm
  - Tape measure on a DC motor
  - Extends as robot leaves starting area to touch target wall
- **Climb**: Chaos Frame
  - Four tracked, rotating arms
  - Capable of rotating 360 degrees
- **Throw:** Air Cannon
  - Pneumatic cannon at 200 psi
  - 2.5” PVC pipe
  - Nearly same diameter as tennis ball
- **Hit**: Golf Club Head on Vane Actuator
  - Air pressure is converted to rotary motion
  - Rotary motion of vane actuator swings golf club
- **Lift:** Bushranger Air Jack
  - Placed between two plates
  - Quickly inflates and deflates
  - Capable of lifting 4 tons 75cm vertically

Bushranger Air Jack in action

Current Developments

- **Analyzing** the stress on load-bearing components
- **Machining** structural components
- **Programming** a virtual controller to simulate the assembled system
- **Purchasing** store-bought components
- **Constructing** testing systems to evaluate performance



Stress analysis of robot legs

Future Work

- Finalize detailed elements of the design and component selections
- Continue ordering components
- Continue machining the structure
- Test robot for performance issues

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